

UNITED STATES OF AMERICA:
WAR DEPARTMENT.

MONTHLY WEATHER REVIEW.

(GENERAL WEATHER SERVICE OF THE UNITED STATES.)

JULY, 1887.

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List of merchant marine steam and sailing vessels from which International Simultaneous Meteorological reports were received at the Office of the Chief Signal Officer, U. S. Army, Washington, D. C., in time to be used in the preparation of the Weather Review for the month of July, 1887.

Name of vessel.	Captain.	Name of vessel.	Captain.	Name of vessel.	Captain.
Alcoa Line.		Logland Line.		White Star Line.	
Br. s. s. Austrian	Capt. J. Bentley.	Br. s. s. Bulgarian	Capt. E. Parry.	Br. s. s. Adriatic	Capt. I. G. Cameron.
Buenos Ayres	J. Scott.	Island	T. H. Fox.	G. Burton.	G. Burton.
Greco	C. E. Le Gallian.	Virginia	M. Pitt.	Britannic	H. Davison.
Hibernia	J. Brown.	Lord	J. E. Brady.	Celtic	Benj. Headell.
Prætorian	J. Ambury.	Br. s. s. Benguer Head	J. E. Brady.	Germanic	Benj. Headell.
Sarmatian	W. Richardson.	Mallory Line.		Wilcox Line.	
Scandinavian	John Park.	Am. s. s. City of San Antonio	J. Wilder.	Br. s. s. Bassano	W. Bea.
American Line.		Carondelet	W. F. Evans.	Buffalo	J. H. Malet.
Br. s. s. British King	John Kelly.	Colorado	J. Daniel.	Chicago	J. W. Jones.
British Prince	S. Nowell.	Lampson	M. B. Crowell.	Gallio	R. T. Jones.
British Princess	E. H. Fresh.	Nacac	J. Bolger.	Marango	W. Abbott.
Illinois	G. H. Dodge.	Mine & Dominion S. S. Co.		Otranto	W. Rippeth.
Lord Clive	P. Urquhart.	Br. s. s. Ontario	W. P. Couch.	Rialto	F. Kerr.
Lord Gough	E. M. Hughes.	Sarnia	John Gibson.	Salerno	B. H. Rogers.
Anchor Line.		Morgan Line.		Santiago	B. Potter.
Br. s. s. Australia	A. McRitchie.	Am. s. s. Eureka	R. B. Quick.	Miscellaneous.	
Albatross	J. Brown.	National Line.		Br. s. s. Amoor	H. Gasson.
Anchor	W. Brown.	Br. s. s. Canada	Thos. Foot.	Agua	J. Adair.
British Crown	A. Smith.	Denmark	R. S. Rigby.	Augustine	R. Harwood.
City of Rome	B. D. Munro.	Egypt	J. Sumner.	Belair	G. Dunlop.
Circus	A. Campbell.	England	T. P. Healey.	Ben Led	S. Adamson.
Devolia	Hugh Young.	Erin	J. Robinson.	Bonarabia	ad Off. A. Thomson.
Derian	J. McKeague.	France	A. D. Hadley.	Cervin	Capt. S. Hughes.
Ethiopia	John Wilson.	Greece	A. J. Jeffrey.	Chilian	E. P. Bannister.
Furness	J. Hoderwick.	Helvetia	G. Cochrane.	Devonshire	Mate Samuel Winter.
Olympia	L. Swain.	Holland	Wm. Tysan.	Durham City	Capt. D. D. Galbraith.
Trinacria	G. Mitchell.	Italy	Wm. Pearce.	Earnmoor	R. J. Grey.
Acron Line.		Spain	W. A. Griffiths.	Edith Godden	J. H. Bennett.
Br. s. s. Monte Rosa	O. Thomas.	The Queen	John Milligan.	El Callao	J. Scholtz.
Atlas Line.		Navigation Generale Italienne.		Elcano	V. de Ispizua.
Br. s. s. Alma	J. W. Sanson.	Br. s. s. Gattardo	Domenico Viola.	Emiliano	Don Fer. Bengoa.
Alvina	— McKay.	Letimbro	ad Off. Fr. Dilberto.	Fitzroy	Henry Gibb.
Alvo	D. Williams.	New York and Cuba Mail S. S. Co.		Horden	C. A. Topp.
Andra	T. M. MacKnight.	Am. s. s. Cienfuegos	Capt. F. M. Faircloth.	Hugo	A. de Mugica.
Athena	H. Low.	N. Y., Havana & Mexican Mail S. S. Co.		India	M. Huisen.
Brick's S. S. Co. (limited).		Am. s. s. City of Alexandria	J. W. Reynolds.	Light-ship No. 37	Andrew Jackson.
Br. s. s. Ambrose	E. Blason.	City of Washington	W. M. Rittig.	Ocean Prince	W. J. Milburn.
Clement	T. Burley.	North German Lloyd Steamship Co.		Peconic	G. Evans.
Cyril	J. H. Johnson.	Ger. s. s. Aller	H. Christoffers.	Pawnee	John James.
Berkshire Steam Navigation Co.		Dopau	H. Supmer.	Pomona	J. Legoe.
Br. s. s. Chateau Yquem	C. F. Journell.	Elder	P. H. Berdrow.	Prydain	M. Parry.
Br. s. s. Brooklyn City	W. Fitt.	Elbe	G. Meyer.	Roseville	J. Dove.
Jersey City	E. Horlor.	Ems	Th. Jungst.	Saint Roman	Henry Campbell.
Llandaf City	T. H. Gore.	Fulda	R. Bingk.	Straits of Gibraltar	G. Grips.
Canada Shipping Company.		Main	H. Boedeker.	Saxmundham	T. M. Milne.
Br. s. s. Lake Superior	P. D. Murray.	Rhein	— Topper.	Victory	S. Elcoate.
Lake Winnipeg	H. Campbell.	Saale	H. Richter.	Vertumnus	C. E. Cook.
Cornwall Line.		Trave	W. Willigerod.	Westbourne	L. Murray.
Am. s. s. Louisiana	E. V. Gager.	Werra	R. Busch.	New York Herald Weather Service.	
New Orleans	T. P. C. Halsey.	Occidental and Oriental S. S. Co.		Br. s. s. Anclitia	P. Belmar.
Clyde Line.		Br. s. s. Gaelic	W. G. Pearne.	Britannic	H. Farrell.
Am. s. s. Yosemite	1st Off. J. C. Norton.	Oceanic	J. Metcalf.	Barracouta	Robert Hubbard.
Canard Line.		Ocean Steamship Company.		Caracas	N. M. Hopkins.
Br. s. s. Aurania	Capt. W. H. P. Hains.	Am. s. s. City of Augusta	J. W. Catharine.	City of Puebla	John Deaken.
Bothnia	T. Dutton.	Oceanic Steamship Company.		Devonia	W. G. Crockett.
Catalonia	Edward Wylie.	Am. s. s. Alameda	H. M. Hayward.	Eureka	R. B. Quick.
Cephalonia	Henry Walker.	Old Dominion Steamship Company.		El Paso	H. S. Quick.
Eturia	T. Cook.	Oregon Railway and Navigation Co.		El Monte	J. W. Hawthorn.
Gallia	M. Murphy.	Am. s. s. Columbia	Frank Stevens.	Germania	B. Gleadell.
Pavonia	A. McKay.	Oregon	Fred Bolles.	Knickerbocker	F. Reuble.
Seythia	T. Roberts.	Pacific Mail Steamship Company.		Moravia	O. Penoldt.
Servia	H. McKay.	Am. s. s. Colon	J. Henderson.	Niagara	S. V. Bennis.
Umbria	W. McMichan.	City of Rio de Janeiro	W. B. Seabury.	Nova Scotia	R. H. Hughes.
Edward Carr's S. S. Line.		City of Para	L. Dexter.	Portia	Henry Dawson.
Ger. s. s. Amalfi	Julius Bahr.	Granada	J. L. Lockwood.	Pennsylvania	A. J. A. Mann.
Australia	G. Franch.	Newport	W. G. Shackford.	Samana	W. Taylor.
California	O. Winkler.	Quebec Steamship Company.		Sailing vessels.	
Marsala	N. Maass.	Br. s. s. Ariel	G. S. Locke.	bk. Abyssinian	John Hughes.
Polynesia	A. Kuhn.	Orinoco	J. S. Garvin.	Alice	W. G. Kair.
Tacoma	W. H. Frank.	Red "D" Line.		Artemis	E. E. Mos.
Fibre Line.		Am. s. s. Philadelphia	Sam. Hess.	bg. Abbie Clifford	D. W. Storer.
Fr. s. s. Neustria	P. Yerries.	Red Star Line.		Adria	J. H. Weldon.
Parsons Line.		Belg. s. s. Illinois	G. H. Dodge.	Am. schr. Anna B. Hutchinson	D. Zelluff.
Fr. s. s. Boston City	T. Davison.	Nederland	A. J. Griffin.	bg. Arco	J. W. Cates.
Stockholm City	K. Doyle.	Konland	H. E. Nichols.	bgt. Bonny Doon	C. Burgess.
General Trans-Atlantic Steamship Co.		Pennland	Rud. Weyer.	Ger. bk. Bremerhaven	A. Witte.
Fr. s. s. La Bourgogne	E. Franguel.	Rhynland	J. C. Jamison.	Am. schr. C. B. Church	N. A. Anderson.
La Bretagne	M. de Jousselin.	Vaderland	C. H. Grant.	Am. bk. Carl von Doheln	O. Jonsen.
La Champagne	E. Traub.	Waeland	J. Ueberweg.	sp. Chas. S. Whitney	Geo. D. Spicer.
La Gascogne	Santelli.	Westernland	Com. W. G. Randie.	Am. bk. Chas. R. Lewis	A. Montgomery.
La Normandie	G. de Kersabiec.	Rotterdam Line.		schr. Comet	W. A. Aldrich.
Grand Western S. S. Line.		Ditch. s. s. Edam	Capt. J. H. Taat.	Ger. bk. Cornelius	H. Windhorst.
Br. s. s. Dorset	Ch. Off. E. Crossman.	P. Caland	P. H. Bonjer.	Br. sp. Cypromene	C. Harding.
Warwick	Capt. L. Morice.	Loerdam	G. S. Stenger.	Am. bg. Daley Boynton	N. E. Schaffer.
Worcester	W. Stamper.	Schiedam	A. Potjer.	Ger. sp. Dakota	C. O. Carter.
Gutua Line.		Zaandam	H. v. d. Zee.	Am. schr. Edward H. Emerson	A. H. Child.
Br. s. s. Alaska	Geo. S. Murray.	Rotterdam	G. V. Vis.	Ger. sp. Elinda	T. H. Zinke.
Arizona	S. Brooks.	W. A. Schulten	G. Bakker.	Am. bk. Essex	O. W. Hall.
Nevada	J. Douglas.	Royal West India Mail S. S. Co.		Ger. sp. Fidello	T. H. Schutte.
Wisconsin	E. Bentley.	Ditch. s. s. Orange Nassau	J. A. J. Lacrooy.	Am. bk. Florence	Mate A. P. Goodman.
Wyoming	C. L. Rigby.	Royal Mail Steamship Co.		schr. Florence Rogers	Capt. T. A. McLeod.
Hamburg-American Line.		Am. s. s. City of Dallas	C. W. Read.	Ger. sp. Friedlander	J. Bellmer.
Ger. s. s. Bohemia	B. Karlowa.	State Line.		Nor. bk. Grundloven	G. Scholtz.
Gellert	W. Kuhlwein.	State of Georgia	G. Moodie.	bk. Grunloven	O. G. Ellingsen.
Gothia	H. Bauer.	State of Indiana	A. Ritchie.	Hanna	S. Faich Muns.
Hammoulin	H. F. Schwensen.	State of Pennsylvania	A. J. A. Mann.	Dich. bk. Helena	T. T. Verbeet.
Leasing	H. Barends.	State of Nebraska	A. G. Brass.	Br. bkt. Josephine	Adam Smith.
Rheita	R. Karlowa.	State of Nevada	J. A. Stewart.	bk. Jose E. More	A. Lenhard.
Rugia	A. Albers.	Thingalla Line.		bg. Kenilworth	P. Doig.
Slavonia	H. Schmidt.	Thingalla	C. W. Muller.	sp. Komander Svend Foyr	J. Bryde.
Suevia	C. Ludwig.	Hekla	A. G. Thomson.	Am. bg. L. F. Manson	J. V. McKowen.
Wieland	C. Habich.	Island	W. Skjold.	L. & W. Armstrong	A. Alexander.
Iman Line.		Thingalla	S. T. H. Laub.	bk. Lazzaro Bianchia	D. Nicola.
Br. s. s. City of Chester	A. Lewis.	Twin River Line.		Ger. bk. Leocadia	John Stohf.
City of Chicago	Fred Watkins.	Br. s. s. Richmond Hill	A. Hyde.	Am. bg. Lillan	H. T. Schive.
City of Richmond	A. Redford.	Ludgate Hill	F. Archer, B.N.B.	Br. sp. Mabel Taylor	Chas. E. Dukes.
City of Montreal	R. Leitch.	Tyne and Wear Steamship Co.	ad Off. H. Dunaway.	Am. bk. Mobican	Benj. Berry.
British Queen	B. Wills.	Br. s. s. City of Newcastle	Capt. R. Townsend.	schr. Pardon G. Thomson	A. B. Chase.
Johnson Line.		United States and Brazil Mail S. S. Co.		Br. bk. Rothemay	Ch. Off. O. M. Lund.
Br. s. s. Neamore	Geo. Elliott.	Am. s. s. Advance	James Lord.	Am. bg. Ruby	Capt. A. J. von Post.
Loupport & Holt's Steamship Company.		Warren Line.		bk. Sarah	L. R. Hale.
Br. s. s. Herchal	G. Draithwait.	Br. s. s. Iowa	Samuel Walters.	Am. bg. Sarah Doe	B. S. Merryman.
Monart	W. Sprathly.	Kansas	W. Gielg.	bk. Stacy Clark	O. M. Haskell.
Biela	F. Graham.	Norwegian	E. Maddox.	bk. Teresa Accane	G. Bostto.
Euclid	A. Matheson.	White Green Line.		Br. bk. Tiber	D. Keife.
Kepier	P. H. Tanner.	Belg. s. s. DeRuyter	J. J. Brarena.	Am. bk. Thille Baker	J. W. Carty.
Olbert	Jas. Clark.	Pieter de Coninck	E. Smit.	sp. Union	H. Fokken.
		Jan Broydel	H. Meyer.	bk. Victoria	B. F. Rehm.

UNITED STATES SIGNAL SERVICE

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INTRODUCTION.

This REVIEW treats generally the meteorological conditions of the United States and Canada for July, 1887, and is based upon reports of regular and voluntary observers of both countries. Descriptions of the storms which occurred over the north Atlantic Ocean during the month are also given, and their approximate paths shown on chart i, on which also appears the distribution of icebergs and field ice reported. In tracing the centres of the paths of these storms, data from the reports of two hundred and twenty-seven vessels have been used. The storms which occurred over the ocean were rather evenly distributed throughout the month, and developed greatest energy to the eastward of the fortieth meridian; barometric pressure below 29.00 inches (762.0 mm.) being reported on two dates. There was an unusual prevalence of fog in the vicinity of Newfoundland, and the dotted shading on chart i shows the limits of the fog-belts to the westward of the fortieth meridian.

The average number of areas of low pressure for July during the last fourteen years is nine; on chart i for the present month are traced the paths of seven such areas, or two less than the average for July.

Over the central and northern portions of the country to the east of the Rocky Mountains the most noteworthy meteorological feature of this month is the unusually high mean temperature, the region of greatest excess of heat being the lower lake region and portions of the Ohio Valley and middle Atlantic states, where the temperature averaged from 4° to 7° above the normal. Chart v exhibits, for selected stations in the heated area, curves illustrating the current and normal temperatures of July, and will be found of especial interest, as this month over a large part of the country has been the warmest that has occurred since the establishment of Signal Service stations.

The monthly precipitation for the Atlantic coast and east Gulf states, extreme northwest, and for portions of the middle and southern Rocky Mountain districts, is generally in excess of the average; in the Lake region, central valleys, and west Gulf states it is below the average.

The very heavy rains near the close of the month in Georgia and South Carolina, caused a destructive freshet in the Savannah River, which at Augusta, Ga., was higher than has been known for more than twenty years. Local freshets in the smaller streams were numerous during the month in the states bordering on the Atlantic.

In the preparation of this REVIEW the following data, received up to August 20, 1887, have been used, viz., the regular tri-daily weather-charts, containing data of simultaneous observations taken at one hundred and thirty-three Signal Service stations and twenty-four Canadian stations, as telegraphed to this office; one hundred and sixty-seven monthly journals and one hundred and sixty-nine monthly means from the former and twenty-four monthly means from the latter; two hundred and sixty-nine monthly registers from voluntary observers; sixty monthly registers from United States Army post surgeons; marine records; international simultaneous observations; marine reports through the co-operation of the "New York Herald Weather Service;" abstracts of ships' logs furnished by the publishers of "The New York Maritime Register;" monthly weather reports from the local weather services of Arkansas, Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Mississippi, Missouri, Nebraska, New England, New Jersey, North Carolina, Ohio, Oregon, South Carolina, and Tennessee; and the Central Pacific Railway Company; trustworthy newspaper extracts, and special reports.

ATMOSPHERIC PRESSURE (expressed in inches and hundredths).

The distribution of mean pressure for July, 1887, determined from the tri-daily telegraphic observations of the Signal Service, is shown by isobarometric lines on chart ii. The area of maximum pressure for July is shown by the isobar of 30.1, and occupies the north Pacific coast; the area of minimum pressure covers portions of the southern and middle plateau districts, and is indicated by the isobar of 29.85. The mean pressure over all the districts to the east of the Rocky Mountains generally ranges between 29.9 and 30.0, being greater over the southern portions of the country than in the northern districts.

Compared with the mean pressure for the preceding month, an increase is shown along the south Atlantic and Gulf coasts, and over the entire country from the Mississippi River to the Pacific coast; the excess is more than .10 over nearly all of the Rocky Mountain region, and over portions of the middle and southern plateau districts it amounts to .15 or more. To the eastward of the Mississippi, north of the thirty-fifth parallel, the mean pressure for July is slightly below that for June, the deficiency being less than .05, except in the Saint Lawrence Valley, New England, and the Maritime Provinces of Canada, where it is .05, or slightly more.

The departures from the normal pressure for the various sta-

tions are given in the tables of miscellaneous meteorological data; they are also graphically exhibited on chart iv by lines connecting stations of normal or equal abnormal values. As will be seen from this chart the mean pressure for July is about normal over nearly the whole country; the maximum deficiency being .03, and the maximum excess, .06. The region over which a deficiency occurs extends from the Gulf of Mexico northward to the Lake region, Minnesota, and Dakota, while in all other districts the mean pressure is normal or slightly above.

BAROMETRIC RANGES.

The monthly barometric ranges at the various Signal Service stations are also given in the table of miscellaneous data. The following are some of the extremes:

Greatest.		Least.	
	Inch.		Inch.
Duluth, Minn.....	0.69	San Diego, Cal.....	0.22
Albany, Mich.....	0.67	Key West, Fla.....	0.23
Boston, Mass.....	0.66	Cedar Keys, Fla.....	0.23
Mount Washington, N. H.....	0.65	Brownsville, Tex.....	0.25
New Haven, Conn.....	0.64	Rio Grande City, Tex.....	0.27
Marquette, Mich.....	0.63	Corpus Christi, Tex.....	0.27
Mackinaw City, Mich.....	0.62	Los Angeles, Cal.....	0.27

AREAS OF HIGH PRESSURE.

In the examination of the tri-daily weather charts, constructed with reports received from the Dominion of Canada and all parts of the United States, eight well-defined areas of high pressure have been traced with sufficient accuracy to warrant a brief description of them. The general direction of movement of these high areas has been easterly, with the exception of numbers iii and v, which was southerly. Six of these areas first appeared off the coast of Oregon and Washington Territory; one moved southwestward from the vicinity of Newfoundland, and the remaining one passed northeastward along the Atlantic coast. In tracing their tracks it was noticed that a high area prevailed during nearly the whole month off the coast of Oregon and Washington Territory, and, at intervals, it would apparently start eastward, divide into two areas, one returning to the coast and the other taking an easterly course.

The attendant phenomena upon the areas traced for July have not been of such a positive character as to warrant a description of each. Light gradients, both in pressure and temperature, generally fair weather, and moderate wind velocities have been the general accompanying conditions.

The following are general descriptions of the tracks pursued by the several areas of high pressure:

I.—This area is a continuation of number iv for the month of June. On the 1st of July it was off the North Carolina coast, with a pressure of 30.24. It moved slowly northeastward and disappeared on the 6th off the coast of Nova Scotia.

II.—This area was central off the coast of Oregon on the 1st. After remaining in that vicinity for seven days it started rapidly eastward, arriving in West Virginia on the 12th. It then moved southward and left the east Florida coast on the 14th.

III.—The morning reports of the 7th located this area on the coast of Washington Territory. It remained in that vicinity until the 11th, when it started eastward over British Columbia and Manitoba, arriving over the Province of Ontario on the 15th. It then took a southwesterly course towards Texas, and disappeared off the Texas coast on the 18th.

IV.—This area was first located off the coast of Washington Territory on the 13th. It started eastward on the 16th and moved directly to Nebraska. It then changed its course to northeast and passed beyond Lake Superior on the 20th.

V.—The morning reports of the 19th indicated that a high area was approaching Nova Scotia from the north. It moved slowly southward, and after remaining off the coast of Nova Scotia until the 25th it disappeared.

VI.—This area was first located off the Oregon coast on the 21st. It moved rapidly eastward to Lake Huron; it then changed its course to the northeast and passed beyond the stations of observation on the 24th.

VII.—The morning reports of the 23d indicated the approach of a high area from the Pacific Ocean to the Oregon coast. It soon after appeared and moved over Washington Territory. It then changed its course and moved southeasterly into southern Dakota; it then passed directly eastward over the Lake region to the coast of Nova Scotia, where it disappeared on the 31st.

VIII.—On the morning of the 25th a pressure of 30.24 was reported from Washington Territory. The centre of the high area seemed to be to the northward. It moved into British Columbia and then started southeastward to Iowa. It then pursued a northeast course and was central north of Lake Huron on the 31st.

AREAS OF LOW PRESSURE.

Seven areas of low pressure have been defined and their paths traced from the tri-daily observations for the month of July. Chart i exhibits these paths. Three of the low areas were first noticed in the region north of Montana, the fourth in Colorado, the fifth in Iowa, the sixth north of the Province of Quebec, and the seventh in the vicinity of the Windward

Islands, West Indies. The course of six of them was generally eastward, with several peculiar temporary deviations. The seventh followed the course usual for West Indies' cyclones, and will be more fully described hereinafter.

The following table shows the time first and last observed, latitude and longitude, and the average hourly velocity of each area of low pressure traced for July:

Areas of low pressure.	First observed.			Last observed.			Average progress in miles per hour.
	Date and time.	Lat. N.	Long. W.	Date and time.	Lat. N.	Long. W.	
No. I.....	1, 3 p. m.	35 00	103 00	8, 3 p. m.	49 00	57 00	20.0
II.....	7, 3 p. m.	53 00	111 00	11, 10 p. m.	43 00	60 00	23.0
III.....	8, 11 p. m.	54 00	116 00	11, 7 a. m.	97 00	43 00	23.0
IV.....	13, 7 a. m.	52 00	70 00	14, 3 p. m.	47 00	50 00	20.0
V.....	13, 3 p. m.	52 00	115 00	19, 7 a. m.	36 00	75 00	32.0
VI.....	20, 10 p. m.	41 30	92 00	23, 3 p. m.	51 00	67 00	38.0
VII.....	22, 7 a. m.	15 00	70 00	31, 10 p. m.	34 00	89 00	10.0

Average rate of progress, 22.6 miles per hour.

The following are brief descriptions of the areas of low pressure traced, with mention of some of the more important meteorological conditions attending them:

I.—The afternoon reports of the 22d indicated the presence of a light barometric depression in southern Colorado, with a minimum pressure of 29.74. It at once moved to Lake Superior, with a decrease in pressure to 29.68. Its subsequent course was eastward, passing over the lower Saint Lawrence valley and Newfoundland, leaving the coast on the 8th, with a central pressure of 29.42. It was attended in its whole course by light rain and occasional brisk winds.

II.—On the afternoon of the 7th a pressure of 29.68 was reported from the region just north of Montana. Subsequent reports disclosed a well developed area of low pressure. It moved over a path slightly south of east and passed off the New England coast on the 11th, with a minimum pressure of 29.56. Light rains and fresh to brisk winds prevailed in its vicinity during its eastward progress.

III.—This area of low pressure was first noticed in the Saskatchewan Valley on the evening of the 8th, with a minimum pressure of 29.68. It moved slowly southeastward into southern Dakota where it disappeared on the 11th. Light rains fell in Nebraska and Dakota along its path.

IV.—A low area appeared in the lower Saint Lawrence valley on the morning of the 13th, accompanied by light rains and fresh winds. It at once moved eastward and passed beyond the field of observation on the afternoon of the 14th.

V.—The pressure on the afternoon of the 13th was reported as 29.50 in the region just north of Montana. Subsequent reports indicated that a well defined low area was moving southeastward. On the 14th it was central in eastern Dakota. On the 15th it had moved southwestward into Colorado. It at once began moving northeast and was over Lake Superior on the 16th. Its course was then changed to southeast and it passed over lower New England on the 18th. It afterwards moved southward along the coast to Virginia and disappeared on the 19th. During its whole progress its gradient was very light, often not averaging one-tenth of an inch for two hundred miles. Occasionally light rains and light winds prevailed along its path.

VI.—The evening reports of the 20th from the central Mississippi valley defined a slight barometric depression accompanied by an area of cloud and rain. The rain-area rapidly spread over the country eastward to the Atlantic coast, and the low pressure area slowly moved eastward to Indiana and then northeastward to the lower Saint Lawrence valley, disappearing on the 23d. The extended area of rain which prevailed during the progress of this low area was remarkable, covering the entire country east of the Mississippi River.

VII.—This low area was the only depression which passed within the limits of observation during the month that proved to be dangerous to all classes of vessels. Its first appearance

and subsequent course entitle it to be placed among that class of storms known as West Indies' cyclones.

The following report of Mr. A. P. Goodman, mate of bark "Florence," of Boston, located at Barbadoes during the time it prevailed in that vicinity, will illustrate its severity:

July 20th.—During the last two days we have had light squally weather, with rain showers and very close, sultry weather and a falling glass. At 4 a. m., Greenwich time, 20th of July, the weather commenced to threaten, the glass having fallen to 29.64. We put out extra ropes and lines and made all secure for a blow; at 6 a. m. blowing heavy, with squalls of rain and a sea rolling in from the sea; 7.30, wind increasing in the squalls; 8.30, in a terrific squall we parted all our lines and drove over to the other side of the Creek, doing considerable damage; about the same time we saw distress signals out to the Roads, and when daylight broke it was something terrific to look at, there being no less than two barks, one barkentine, one brigantine, one two-masted schooner, one small steamer, and two condemned vessels on the shore; one bark and barkentine completely broken up; the sea was like a mountain on the shore.

The path pursued by this cyclone, as determined by a number of vessels' logs, reports, and observations received from vessels sailing on the Gulf of Mexico, the Caribbean Sea, and vicinity, appears to have been a little south of Barbadoes on the 20th, moving east. It then moved eastward over the central portion of the Caribbean Sea just north of N. 15° to W. 85°, then northwest over the extreme eastern portion of Yucatan to about N. 25°. At about the latter point its path seems to have been northerly for a few degrees and then changed to northeast. It arrived on the coast of western Florida on the morning of the 27th, with a minimum pressure of 29.60 and a wind-velocity of fifty-four miles per hour or more. After reaching the coast of Florida its course con-

tinued northeast to the vicinity of Augusta, Ga., then westward, arriving in northern Mississippi on the evening of the 31st, where it finally disappeared early in August. Its progress through the Caribbean Sea and the Gulf of Mexico appears to have been between fifteen and twenty miles per hour, and was accompanied by destructive winds and heavy rainfall. Reports of a number of vessels wrecked have been received from the western Florida and northern Cuban coasts.

The progress of the cyclone after leaving the Gulf of Mexico was reduced to about ten miles per hour. Its violence also appears to have been slightly reduced, judging from the following maximum wind-velocities, in miles per hour: Cedar Keys, Fla., 54; Pensacola, Fla., 36; Jacksonville, Fla., 36; Savannah, Ga., 36; Augusta, Ga., 20; Atlanta, Ga., 30; Mobile, Ala., 26. The rainfall was very heavy in Florida, Georgia, and eastern Alabama. The following are the total amounts, in inches, reported during the time the influence of the cyclone prevailed: Jacksonville, Fla., 3.50; Titusville, Fla., 4.54; Cedar Keys, Fla., 8.00; Pensacola, Fla., 1.34; Montgomery, Ala., 3.57; Atlanta, Ga., 8.93, and Augusta, Ga., 6.02. This heavy rainfall, in connection with the high winds and swollen rivers, was very destructive to the growing crops and public highways.

Through the kindness of Padre B. Viñes, S. J., Director of the Magnetic and Meteorological Observatory, Belen College, Havana, Cuba, the Chief Signal Officer was kept informed by telegraph of the progress of the cyclone before it reached the coast of the United States, and timely warning was given to the shipping on the Gulf and south Atlantic coasts, both by cautionary wind signals and special storm messages.

NORTH ATLANTIC STORMS DURING JULY, 1887.

[Pressure in inches and millimetres; wind-force by Beaufort scale.]

The paths of the depressions that have appeared over the north Atlantic Ocean during the month are determined, approximately, from international simultaneous observations furnished by captains of ocean steamships and sailing vessels; abstracts of ships' logs and other data collected by the Signal Service agencies at the ports of New York, Boston, and Philadelphia; reports received through the co-operation of the "New York Herald Weather Service;" and from other miscellaneous data received at this office up to August 21, 1887.

Seven depressions are traced, of which two passed eastward over the northern extremity of Newfoundland and advanced to the northward of the British Isles; two moved eastward from the coast of the United States south of the forty-fifth parallel, and three first appeared over mid-ocean. The general course of direction of the depressions was east-northeast, and their rate of progression was, as a rule, slow. Barometric pressure ranging below 29.00 (736.6) was reported on the 8th over mid-ocean, and on the 26th to the southward of Iceland.

The more severe storms of the month were included within three periods, viz., from the 7th to the 12th hard gales prevailed over mid-ocean, attending the passage of depressions numbers 2 and 3; during the 13th, 14th, and 15th fresh gales were occasioned to the southward and eastward of Newfoundland by depression number 4, and from the 25th to the 28th, inclusive, fresh to whole gales occurred from the thirtieth meridian to the British Isles, accompanying depressions numbers 6 and 7. No storm of marked violence occurred off the Atlantic coast of the United States, although moderate gales and unsettled weather were reported west of the fifty-fifth meridian and north of the thirty-fifth parallel during the greater portion of the second and the latter part of the third decades of the month.

From the 11th to the 14th, inclusive, and during the 27th and 28th, the barometric pressure in the vicinity of the Azores was relatively low; during the balance of the month the barometer continued high in that locality. Over mid-

ocean the pressure was high in the trans-Atlantic routes until the 5th, from which date until the 12th the barometer was generally low and fluctuating. During the second decade generally high pressure prevailed, except to the northward of the British Isles and west of the forty-fifth meridian. During the third decade the barometer continued low in, and to the northward of, the trans-Atlantic routes east of the thirty-fifth meridian. The cyclone which passed eastward over the Caribbean Sea and over the Gulf of Mexico during the third decade of the month is described under the heading of "Areas of low pressure."

In July, 1886, twelve depressions appeared over the ocean, of which seven were continuations of areas of low pressure traced on the North American continent; three storms traversed the ocean from coast to coast, one of which first appeared in the Caribbean Sea and passed into the Gulf of Mexico, whence it advanced northeast to the northward of the British Isles, closely following the course of the Gulf Stream.

In July, 1887, the storms, while being somewhat less frequent than in corresponding months of previous years, were of unusual summer strength to the eastward of the fortieth meridian during the three storm periods herein referred to.

The following are brief descriptions of the depressions traced:

1.—This depression was central on the 2d over the northern portion of the Gulf of Saint Lawrence, with barometric pressure ranging to about 29.70 (754.4), whence it moved northeast to about N. 54°, W. 51° by the 3d, with an apparent decrease in central pressure. During the next three days the storm-centre is given a probable track along the fifty-fifth parallel, after which it moved southeast and united with depression number 2 in N. 50°, W. 24° on the 7th.

2.—This depression originated southeast of the Banks of Newfoundland on the 6th, and, moving northeast, united with depression number 1 on the 7th, on which date barometric pressure about 29.30 (744.2) was shown. By the 8th the centre of depression had moved north-northeast to N. 55°, W. 21°,

with barometer readings ranging below 29.00 (736.6), after which it circled westward four degrees, with a marked increase in pressure; during the 10th and 11th the storm moved north-east to the north of Scotland, with an appreciable loss of energy, and disappeared beyond the region of observation after the latter date.

The following special reports refer to disturbances encountered during the passage of depressions numbers 1 and 2:

Capt. T. H. Gove, of the s. s. "Llandaff City," reports a storm of hurricane force on the 7th and 8th; wind veered from sw. to nw.; lowest barometer, 28.88 (733.5), at 9 p. m. of the 7th, in N. 51° 47', W. 21° 16'. Capt. T. Roberts, of the s. s. "Scythia," reports a strong s. to w. gale during the 7th and 8th, between N. 51° 20', W. 15° 32', and N. 50° 47', W. 21° 08'; lowest barometer, 29.30 (744.2), at 5.30 p. m. of the 7th, in N. 51° 9', W. 17° 56'. The gale was accompanied by a high confused sea. Fourth Officer J. H. Donne, of the s. s. "City of Richmond," Capt. A. Redford, commanding, reports a strong s. to w. gale during the 7th and 8th; lowest barometer, 29.22 (742.2), at 8 p. m. of the 7th, in N. 50° 58', W. 17° 47'.

Capt. N. Maass, of the s. s. "Marsala," reports a whole w. to nw. gale from the 7th to 9th; lowest barometer, 29.18 (741.2), at 9 a. m. of the 8th, in N. 46° 26', W. 34° 31'. Commodore W. G. Randle, of the s. s. "Westerland," reports a strong nw. to sw. gale from the 7th to 9th; lowest barometer, 29.81 (757.2), at 9 a. m. of the 8th, in N. 44° 56', W. 38° 03'. Capt. J. Scott, of the s. s. "Buenos Ayrean," reports a moderate gale on the 7th and 8th; wind veered from ne. to e. and sw.; lowest barometer, 28.88 (733.5), at noon of the 8th, in N. 55° 29', W. 24° 04'.

3.—This depression passed eastward over the northern portion of Newfoundland during the night of the 7-8th, and was central on the morning of the 8th in about N. 51°, W. 55°; by the 9th it had advanced about five degrees east, and on the 10th the storm-centre was located in N. 53°, W. 38°, with evidence of great energy; moving slowly south of east the depression was central on the 11th in N. 52°, W. 29°, with pressure about 29.40 (746.7), whence it advanced east-northeast to the northwest of Ireland by the 13th, after which it passed beyond the region of observation.

The following special reports refer to this storm: Capt. M. de Jouselin, of the s. s. "La Bretagne," reports a moderate gale on the 8th; wind veered from sw. to w.; lowest barometer, 29.72 (754.9), at 8 a. m., in N. 42° 07', W. 58° 10'. Capt. E. H. Freeth, of the s. s. "British Princess," reports a moderate to fresh gale from the 7th to the 11th; wind veered from s. to w.; lowest barometer, 29.65 (753.1), at 8 a. m. of the 11th, in N. 46° 52', W. 31° 34'. From the 12th had strong sw. to w. wind to W. 62°.

4.—This depression advanced to the eastward of Nova Scotia by the 12th, with barometric pressure below 29.60 (751.8), and, passing slowly northeast during the 13th, 14th, and 15th, disappeared to the northward of the fiftieth parallel by the 16th. The storm possessed considerable energy, and pressure ranging to about 29.40 (746.7) was shown on the 14th and 15th.

5.—This depression first appeared off the coast of the United States in about N. 39° on the 18th, and moved east-northeast to the eastward of the Newfoundland Banks by the 20th, after which it dissipated. The depression, while being of slight depth, occasioned rain and fresh to whole gales during the 19th and 20th. The following special report has been rendered relative to this storm: Capt. Thos. Davis, of the s. s. "Boston City," reports a whole gale on the 19th; wind veered from s. to sw. and n.; lowest barometer, 29.74 (755.4), at 7 p. m. of the 19th, in N. 48° 31', W. 46° 30'.

6.—This depression is first charted in N. 55°, W. 25°, under date of the 25th, whence it moved northeast to N. 59°, W. 21° by the 26th, with central pressure below 29.00 (736.6), after which the storm-centre passed beyond the region of observation, although its presence to the northward of the British Isles was indicated by south to west gales and rain to the fiftieth parallel during the 27th and 28th. The storm pos-

sessed great energy throughout, as is shown by the following special reports:

Capt. W. Kuhlmann, of the s. s. "Main," reports a strong gale on the 26th and 27th; wind veered from sw. by w. to w. by n.; lowest barometer at 6 p. m. of the 26th, in N. 49° 50', W. 12° 54'. Capt. D. D. Galbraith, of the s. s. "Durham City," reports a heavy wsw. gale, lasting from 4 p. m. of the 26th to 4 a. m. of the 28th; sea very heavy from the westward; lowest barometer, 29.19 (741.4), at midnight of the 26th, between Bardsey Island and Cape Clear.

Capt. W. McMickan, of the s. s. "Umbria," reports: "A fresh w. to wnw. gale on the 25th and 26th; lowest barometer, 29.34 (745.2), at 4 a. m. of the 26th, in N. 50° 00', W. 25° 30'. At 4.30 a. m. of the 26th, or thirty minutes subsequent to the time of lowest observed barometric pressure, a tremendous sea struck the ship forward, carrying away rails of forward bridge, port side; also main upper bridge, and smashing number two hatchway. Water poured down into the forward steerage and forward saloon. The wave appeared to be about twelve feet higher than the ordinary sea running." This vessel was directly in the path of the storm's vortex, the centre of which evidently preceded the wave referred to by the time stated. Capt. H. E. Nickels of the s. s. "Noordland," reports a fresh gale from the 26th to the 28th; wind veered from wsw. to wnw.; thence backed to ssw., and ended at nnw.; lowest barometer, 29.26 (743.2), at noon of the 26th, in N. 49° 47', W. 15° 41'.

7.—This depression moved eastward, north of the fiftieth parallel, to N. 51°, W. 33° by the 27th, with central pressure about 29.30 (744.2), whence it passed northeast to N. 56°, W. 25° by the 28th, and to the north of Scotland by the 29th, with fresh to whole gales throughout.

The following special reports show the general character of the disturbances encountered during its passage:

Mr. T. Cornelius, observer on the s. s. "Scythia," Capt. T. Roberts, commanding, reports a whole gale on the 27th and 28th; wind backed from ssw. to sse., and veered to w.; lowest barometer, 29.30 (744.2), at 5 hours 46 minutes of the 27th, in N. 49° 30', W. 26° 34'. Capt. W. Kuhlmann, of the s. s. "Main," reports a whole gale on the 27th and 28th; wind veered from s. by w. to nw. by n.; lowest barometer at 2 a. m. of the 28th, in N. 49° 42', W. 20° 26'. Capt. A. G. Thompson, of the s. s. "Hekla," reports a strong gale on the 28th; wind backed from ne. to nw.; lowest barometer, 29.23 (742.4), at 2 a. m., in N. 52° 50', W. 32° 15'.

OCEAN ICE.

On chart i are also exhibited the limits within which icebergs and field ice were reported during July, 1887. These limits are determined from reports furnished by shipmasters, and from data collected by the Signal Service agencies.

The easternmost ice was passed on the 5th, in N. 52° 04', W. 41° 16'. By the s. s. "Buenos Ayrean," and the southernmost ice reported was observed in N. 43° 30', W. 50° 05', from the s. s. "Minola."

Ice was most frequently reported during the month over and off the eastern edge of the Banks of Newfoundland, and in and to the eastward of the Straits of Belle Isle; large quantities of ice and large icebergs being encountered in the vicinity of Belle Isle throughout the month.

As compared with ice reported during June, 1887, the southern limit of the ice region has contracted northward about three degrees, while the eastern limit is about two degrees further west. At the close of June no vessel-reports had been made from the north of Newfoundland, which would indicate that ice massed in that region had not broken up, and that as a consequence the route through Belle Isle Straits was not available; with the opening of July, however, reports show that this passage was effected.

As compared with July, 1886, the southern limit of ice is about one and one-half degrees further north, while the extreme eastern position in which ice was observed is about six degrees

further west. In the vicinity of Belle Isle the aggregate quantity of ice reported during July, 1887, greatly exceeded that reported during the corresponding month of 1886.

As compared with the corresponding month of previous years, the southern limit of ice for July, 1887, is about one degree north of the mean southern, and about three degrees east of the mean eastern, limit. More than the usual amount of ice has been encountered off the northern extremity of Newfoundland.

The following table shows the southern and eastern limits of the region within which ice was reported for July during the last five years:

Southern limit.			Eastern limit.		
Month.	Lat. N.	Lon. W.	Month.	Lat. N.	Lon. W.
June, 1883	42 43	49 57	July, 1883	46 47	45 44
June, 1884	46 24	50 02	July, 1884	48 39	49 28
July, 1885	42 14	48 30	July, 1885	48 00	44 00
July, 1886	42 59	49 18	July, 1886	45 52	44 30
July, 1887	43 30	50 05	July, 1887	52 04	41 16

* An isolated iceberg and some field ice.

Icebergs and field ice were reported as follows:

Date.	Vessels.	Position. Lat. N. Lon. W.	Remarks.
1	S. S. Scandinavian.....	44 35 52 45	One berg.
	S. S. Sarnia.....	To eastward and in Straits of Belle Isle.	Several bergs.
	Bk. J. W. Holmes.....	45 40 49 15	One large berg and field ice.
2	S. S. Sarmatian.....	51 27 56 21 to 52 44 52 00	Ten large bergs.
4	S. S. Minola.....	43 30 50 05	One berg.
	Bk. Laura Maria.....	47 27 45 15	One large berg.
	S. S. Buenos Ayrean.....	Cape Norman to 52 04 41 16	Bergs.
5	S. S. Trave.....	47 06 47 07	A piece of ice.
	S. S. Ethiopia.....	47 06 48 13	One very large berg.
7	S. S. Ethiopia.....	In Narrows, Saint John's, N. F.	One berg.
	S. S. Spain.....	46 44 47 23	Do.
9	S. S. Lake Nipigon.....	Straits of Belle Isle	Many large and small bergs; also field ice.
10	do.....	52 36 52 30	One large and two small bergs.
11	S. S. York City.....	45 46 46 34	One berg.
13	S. S. Slavonia.....	46 35 46 48	Two large and several small bergs.
	S. S. Nova Scotian.....	Off entrance to Saint John's harbor.	Two large bergs.
	S. S. Anchoria.....	45 55 44 27	One large berg.
15	S. S. State of Nebraska.....	47 20 50 10	Two large bergs.
	S. S. Jan Breydel.....	46 58 50 25	One large berg.
16	S. S. Nevada.....	43 36 44 20	One berg.
	S. S. Trave.....	46 54 47 31	One very large berg.
	S. S. Trave.....	46 27 47 59	Two pieces of ice.
17	S. S. Grecian.....	46 43 47 32	One berg.
		12 miles west of Greenly Island and through Straits of Belle Isle to N. 53° W. 51° 0.	Large quantities of ice and several very large bergs.
20	S. S. Boston City.....	49 20 50 48	One large and five small bergs.
21	S. S. Arizona.....	46 40 47 39	One large berg.
	S. S. Devonian.....	46 55 47 30	Do.
	S. S. Corona.....	46 46 47 38	Do.
	S. S. Maryland.....	48 00 47 30	Two medium bergs.
	S. S. Queen.....	47 50 48 44	One very large berg.
	S. S. Austrian.....	46 45 47 30	One large berg.
	S. S. Sarmatian.....	45 08 49 22	Do.
		48 21 49 12	Do.
		48 01 50 18	One very large berg.
		52 48 51 11 to 51 27 55 51	Sixty bergs and small pieces.
22	S. S. Corona.....	48 21 49 13	One large berg.
	S. S. Dorset.....	48 01 50 18	One very large berg.
	S. S. Ontario.....	47 30 50 00	Do.
23	S. S. Dorset.....	46 30 53 40	One medium berg.
	S. S. Straits of Gibraltar.....	47 44 48 36	One berg.
24	S. S. Brooklyn City.....	52 30 53 30	Several large bergs; also large bergs to and in the Straits of Belle Isle.
25	S. S. Sarnia.....	50 29 47 29	One berg.
	S. S. Lake Nipigon.....	30 miles east of Belle Isle.	Many large and small bergs.
26	S. S. La Gascogne.....	49 49 48 44	One berg.
	S. S. Furnessia.....	47 50 48 30	Do.
	S. S. State of Georgia.....	46 13 46 01	One large berg.
30	S. S. State of Georgia.....	46 01 46 35	Do.
	S. S. Lake Nipigon.....	47 58 49 06	Two large and seven or eight small bergs.
		Near Belle Isle and in straits.	Many large and small bergs.

FOG.

The following table shows the limits of fog-areas on the north Atlantic Ocean during July, 1887, as reported by ship-masters:

Date.	Vessel.	Entered.			Cleared.		
		Lat. N.	Lon. W.	Time.	Lat. N.	Lon. W.	Time.
1	S. S. Prydian.....	42 06	65 15	.....	42 06	66 00	.....
1	S. S. Eider.....	46 47	46 36	.....	45 54	49 48	.....
1	S. S. Donau.....	42 20	55 45	.....	42 50	48 50	.....
2	Brig. Arcot.....	41 22	69 12	.....	40 49	69 14	.....
2	S. S. Scandinavian.....	43 18	59 06	.....	43 20	59 20	.....
2	S. S. Donau.....	43 30	47 30	.....	43 30	47 30	.....
3	S. S. Circassian.....	40 59	67 30	.....	40 42	69 16	.....
3-4	S. S. Island.....	47 21	45 30	.....	44 50	53 00	.....
4	S. S. Main.....	41 30	46 20	.....	41 10	48 00	.....
4	S. S. Eider.....	41 14	65 59	.....	40 54	69 36	.....
4	S. S. Main.....	41 45	53 03	.....	41 53	50 54	.....
5	S. S. Island.....	43 50	54 00	.....	43 10	58 05	.....
5	S. S. Main.....	44 01	42 54	.....	44 34	43 00	.....
4-5	S. S. Greece.....	40 40	48 14	11 p. m.	40 50	46 42	6 a. m.
6	Brig. Arcot.....	39 05	73 46	.....	Delaware River		
7	S. S. La Bretagne.....	43 00	49 20	.....	42 45	52 35	.....
7-8	S. S. Servia.....	44 00	46 49	.....	42 30	51 00	.....
8	Sp. George.....	41 20	48 27	.....	40 59	48 30	.....
8	S. S. Bengore Head.....	42 23	52 20	.....	42 24	49 28	.....
8-9	S. S. Ems.....	43 44	54 17	.....	44 28	51 30	.....
9	do.....	45 38	47 18	.....	46 28	44 37	.....
11	S. S. Australia.....	41 32	51 35	.....	41 31	51 45	.....
11-12	S. S. Erin.....	41 15	46 45	.....	41 14	48 30	.....
12	S. S. City of Richmond.....	41 33	46 30	.....	40 49	48 48	.....
12-13	S. S. Celtic.....	43 43	49 00	11.52 p. m.	42 44	51 54	2.57 p. m.
13	S. S. Scythia.....	42 55	50 17	.....	42 54	50 37	.....
13	S. S. Rhaetia.....	43 30	46 14	.....	42 50	51 20	At inter-vals.
14	S. S. Leocadia.....	42 34	46 56	.....	42 41	48 41	.....
14	S. S. Vaderland.....	44 59	38 48	.....	44 50	39 21	.....
14	S. S. Italy.....	48 10	43 52	.....	45 20	50 32	.....
14	S. S. Saale.....	44 52	50 12	.....	43 26	50 30	.....
15	S. S. Ludgate Hill.....	45 16	48 38	.....	44 32	51 36	.....
15	S. S. Warwick.....	47 32	46 10	3 a. m.	40 15	49 40	8 p. m.
15-16	S. S. Wyoming.....	47 32	43 34	7 a. m.	44 28	52 24	4 p. m.
16	S. S. Netley Abbey.....	42 45	49 05	.....	42 43	50 20	.....
16	S. S. Trave.....	47 26	44 57	.....	47 57	42 22	.....
17	S. S. Servia.....	40 20	67 50	.....	40 25	67 00	.....
18	Sp. George.....	42 24	60 50	.....	42 45	61 35	.....
18-20	S. S. Leerdam.....	47 35	42 46	9.20 p. m.	45 40	48 16	2.40 a. m.
20	S. S. Chateau Yquem.....	40 33	68 05	9.30 a. m.	40 30	69 48	4 p. m.
20-21	S. S. Aurania.....	47 30	38 00	.....	43 03	51 50	.....
22	do.....	42 37	55 01	.....	43 29	56 27	.....
22-23	S. S. Devonian.....	44 33	57 34	.....	45 13	59 56	.....
23	S. S. Analf.....	46 00	44 30	.....	43 30	52 10	.....
24	S. S. Scythia.....	42 16	50 00	.....	42 28	49 49	.....
24-25	do.....	42 33	49 38	.....	44 32	44 51	.....
25-26	S. S. Analf.....	41 12	66 20	.....	40 40	69 30	.....
27	S. S. La Bourgogne.....	43 51	51 49	2 a. m.	45 10	49 06	10 p. m.
28	S. S. Umbria.....	43 40	47 35	.....	42 20	52 30	.....
30	S. S. Hekla.....	46 20	44 30	.....	45 30	46 00	.....
31	S. S. Main.....	47 27	43 10	11 a. m.	46 25	46 44	11.30 p. m.

On chart i the limits of fog-belts to the westward of the fortieth meridian are shown by dotted shading.

In the trans-Atlantic tracks fog was most frequently encountered between the forty-second and fifty-third meridians, and over and in the vicinity of George's Shoal, the southern limits of the fog-belts being in about N. 40° 30'. Between the fifty-third and sixty-fifth meridians there was a comparative absence of fog. Advices indicate that there was an unusual prevalence of fog near the Newfoundland Banks during the month, which fact may be attributed to the abnormally high air temperatures reported to the westward of the fortieth meridian, whereby the differences in temperature requisite to fog development were more marked along the southern edge of the Arctic current, and in the vicinity of the ice-fields. A study of the general meteorological conditions which prevailed during and preceding the development of fog over and near the Banks of Newfoundland shows that, as a rule, its denser formation attended the shift of wind to southerly in the eastern quadrants of low barometer areas, by means of which the warm, vapor-laden air from the Gulf Stream was blown over the surface of the ice-fields and Arctic current.

Out of a total of twenty-three days for which fog was reported over or near the Newfoundland Banks, the presence of a cyclonic centre in the vicinity of Newfoundland or Nova Scotia was shown on fourteen dates; on five dates a low barometer area was located in the Saint Lawrence Valley or Gulf, and on four dates the meteorological conditions were unsettled, with rain, following the passage to the eastward of a cyclonic area. In the vicinity of George's Shoal fog was

reported on eight dates, and the dependence of its development upon south to east winds was apparent, although the precipitation of fog atoms was evidently due more to the contact between cold, northerly winds to the westward of low barometer areas and the warm, humid air from the Gulf Stream that had been collected in that region by the winds preceding storm-centres, than to differences in temperature of air overlying the ocean currents. The forcing to the surface

of the colder, deep-flowing waters of the Arctic current over George's Shoal, doubtless contributed to denser and more frequent fog formations in that locality.

Reports show that in the vicinity of Newfoundland a disappearance of fog closely followed a shift of wind to northerly, and in instances wherein fog was encountered to the southward of the Banks its presence was occasioned by a drift of fog-banks following a shift of wind to northerly.

TEMPERATURE OF THE AIR (expressed in degrees, Fahrenheit).

The distribution of mean temperature over the United States and Canada for July, 1887, is exhibited on chart ii by the dotted isothermal lines. In the table of miscellaneous data are given the monthly mean temperatures, with the departures from the normal, for the various stations of the Signal Service; the figures opposite the names of the geographical districts in the columns for mean temperature, precipitation, and departures from the normal, show respectively the averages for the several districts. The normal for any district may be found by adding the departure to the current mean for the district when the departure is below the normal, and subtracting when above. On chart iv the departures from the normal are illustrated by lines connecting stations of normal or equal abnormal values.

Over the region east of the one hundredth meridian, north of the thirty-fifth parallel (which embraces nearly the whole of the United States east of the Rocky Mountains), the month of July was exceptionally warm, the mean temperature over the greater part of the country named being more than 2° above the normal, while in the Lake region, Ohio Valley, and middle Atlantic states the excess ranged from 4° to 7°. The mean temperature was also above the normal in the plateau districts, but in this region the departures were very slight. In the Gulf States, over the eastern Rocky Mountain slope, and along the immediate coast of the Pacific the month was cooler than the average July, but the deficiency in the monthly mean temperature was generally less than 2°, although a few stations show more marked departures.

The following are some of the most marked departures from the normal temperature at Signal Service stations, where the period of observation covers ten years, or more:

Above normal.		Below normal.	
Pittsburg, Pa.	7.6	San Francisco, Cal.	3.8
Buffalo, N. Y.	6.9	Charleston, S. C.	3.6
Toronto, Ontario	6.5	New Orleans, La.	3.5
Port Huron, Mich.	6.4	Vicksburg, Miss.	3.1
Cleveland, Ohio	6.3	Brownsville, Tex.	1.8
Kingsport, Ontario	6.1	Rio Grande City, Tex.	1.5
Erie, Pa.	5.8	Montgomery, Ala.	1.3
Columbus, Ohio	5.8	Galveston, Tex.	1.1

At many of the Signal Service stations, where the period of observation extends back ten to fifteen years, the maximum, minimum, and the mean temperatures of July were the highest shown by the records. The intense heat of the second decade of the month caused great suffering in the region from the upper Mississippi valley eastward to the Atlantic, and the number of deaths and prostrations resulting therefrom was unusually large. The table of comparative maximum and minimum temperatures in the REVIEW for this month will be found of especial interest as showing the highest temperatures yet recorded at many stations.

The curves on chart v show the current and normal temperatures for July at the stations given in the following table. This chart is of special interest in connection with the notes given in this REVIEW relative to the unusually warm weather of July. The solid lines in the diagram referred to represent the normal for past years, and the dotted lines, the current temperature for July, 1887:

The following table shows the number of days on which the

temperature was normal, above the normal, or below, etc., at the several stations:

Stations.	Number of days.			Extremes.				Monthly mean excess, degrees.	Length of record, years.
	Normal.	Above normal.	Below normal.	Above normal.		Below normal.			
				Degrees.	Date.	Degrees.	Date.		
Buffalo, N. Y	29	2	12.7	3	3.7	10	6.9	15	
Louisville, Ky	31	7	11.7	20	5.0	3	4.3	14	
Milwaukee, Wis	20	18	18.	15	9.	24	4.4	15	
New York City	22	9	9.0	13	3.3	19	3.7	15	
Pittsburg, Pa	20	14	14.	17	3.	10	7.6	11	
Port Huron, Mich	1	27	14.3	15	6.7	23	6.4	15	
Saint Louis, Mo	25	13	13.	30	3.	22	5.7	15	
Washington City	22	10.3	29	3	3.0	4	4.3	15	

RANGES OF TEMPERATURE.

The monthly, and the greatest and least daily, ranges of temperature, at Signal Service stations are given in the table of miscellaneous meteorological data.

The monthly ranges were greatest over the middle plateau and at stations along the northern border of the country from Washington Territory to Lake Superior, where they were generally above 50°; they were least along the south Atlantic, Gulf, and Pacific coasts, where they varied generally from 20° to 30°.

The following are some of the greatest and least monthly ranges at Signal Service stations:

Greatest.		Least.	
	66.0	Eureka, Cal	16.9
Fort Klamath, Oregon.....	65.0	San Diego, Cal	19.3
Ashland, Oregon.....	59.6	Key West, Fla.....	19.8
Fort Spokane, Wash.....	59.4	Corpus Christi, Tex.....	20.6
Boise City, Idaho.....	55.5	San Francisco, Cal.....	20.9
Poplar River, Mont.....	54.9	Fort Canby, Wash.....	21.6
Huron, Dak.....			

The greatest daily ranges over the entire country varied from 16° at Key West, Fla., on the 2d, to 53° at Fort Klamath, Oregon, on the 5th; along the Atlantic and Gulf coasts, in the Lake region, Ohio and central Mississippi valleys they varied generally from 20° to 30°; in the Rocky Mountain region they generally exceeded 40°.

The least daily ranges varied from 5° to 10° at stations in the vicinity of the Atlantic, Pacific, and Gulf coasts; over the interior of the country they were generally from 10° to 15°, except in the Rocky Mountain districts, where they were 20° or more.

HIGH TEMPERATURES.

The following notes, relative to the high temperatures of the month, have been received from Signal Service and voluntary observers:

Clinton, Clinton Co., Iowa: the period from the 5th to the 17th may be called the heated term of the month; the maximum temperature, 104°, occurred on the 16th; the mean temperature for the period named was 80°; both the maximum and mean are the highest on record at this place; on five days the temperature rose above 100°.

Red Bluff, Cal.: the temperature rose to 112° on the 8th; this is the highest since the establishment of the signal office in 1877.

Cairo, Ill.: on the 12th the weather was hot and sultry, maximum tempera-

ture, 94°; two cases of prostration by heat were reported; on the 13th the excessive heat caused partial suspension of all out-door work.

Davenport, Iowa: four cases of prostration by heat occurred on the afternoon of the 12th; on the 16th several cases of prostration from heat occurred; on the latter date out-door work was suspended on account of the intense heat. Several cases of prostration by heat also occurred on the 29th.

Louisville, Ky.: a large number of sunstrokes occurred in this city during the period of intense heat from the 15th to the close of the month; the maximum temperature of the month, 102°, occurred on the 29th.

Saint Louis, Mo.: the intense heat from the 15th to 18th and from the 28th to 30th caused a large number of sunstrokes, many of which proved fatal.

Milwaukee, Wis.: the highest temperature recorded at this station since its establishment occurred on the 16th; the maximum, 100°, was recorded at 3.50 p. m.

Baltimore, Md.: the 16th was the hottest day that has occurred since September 7, 1881, the temperature reaching 101°; one death and several prostrations from heat occurred. On the 17th the temperature reached 99°, and several fatal cases of sunstroke occurred; on the 18th the temperature rose rapidly to 102°, which is the highest recorded since the opening of station in 1871; the weather was oppressively warm on the 29th, 30th, and 31st, and several fatal cases of sunstroke occurred.

La Crosse, Wis.: the maximum temperature of the month, 98°, on the 16th, is the highest recorded at this station since July 6, 1874, when the temperature reached 101°; the minimum temperature for the month, 49°, on the 23d, is the lowest temperature recorded in July since the establishment of the Signal Service station in 1872.

Dubuque, Iowa: the average temperature for the 16th was 90°, and the maximum 101°; in but one instance since the establishment of the Signal Service station in 1873 has the temperature been as high, viz., in July, 1874.

Clayton, Gloucester Co., N. J.: July has been the most remarkable month recorded since an authentic meteorological record has been kept at this place. Only six days during the month did the temperature fall below 70°, while it rose above 90° on eighteen days. The highest daily average temperature of the month, 86°, occurred on the 17th, and the lowest, 73°, on the 19th.

Terre Haute, Ind.: the temperature reached 102° on the 17th; this is the highest recorded since 1881.

Kitty Hawk, N. C.: the weather on the 18th was intensely warm, maximum temperature 107°; this is the highest temperature recorded at this station since its establishment in 1875.

Charleston, S. C.: many persons were overcome by the intense heat of the 18th; a few fatal cases of sunstroke were reported.

Lynchburg, Va.: business was practically suspended on the 18th on account of the intense heat; at 2 p. m. the thermometer, in the shade, indicated 106°.

Columbia, S. C., 18th: the excessive heat of the last five days has been unprecedented; the maximum temperature on this date was 104°. Three deaths from sunstroke and several cases of dangerous prostration from heat have occurred. Sunstrokes are very unusual in this region.

Norfolk, Va.: the maximum temperature on the 18th was 102°; the excessive heat caused several deaths and many prostrations. Out-door work was generally suspended on the 26th, on which date the heat was very oppressive and many prostrations occurred.

Cincinnati, Ohio, 19th: the intense heat of the past six days has interfered generally with business of all kinds. On the 16th the number of prostrations reached forty, of which ten were fatal; more than sixty cases of sunstroke occurred on the 17th.

Sandwich, De Kalb Co., Ill.: the maximum temperature of July, 1887, was 103°; this has been reached or exceeded during the last thirty-seven years in but three instances, viz., 105° in July, 1856 and 1858, and 103° in August, 1881.

Albany, N. Y.: the mean temperature for the month, 77°, is the highest recorded in July since the establishment of this station in 1874.

DEVIATIONS FROM NORMAL TEMPERATURES.

In the table below are given, for certain stations, as reported by voluntary observers, the normal temperatures of July for a series of years, the mean temperature for July, 1887, and the departures from the normal:

Station.	County.	Normal temperature for July.	Number of years.	Mean temperature for July, 1887.	Departure.
<i>Arkansas.</i>		°		°	°
Lead Hill.....	Boone.....	80.2	5	82.8	+ 2.6
<i>California.</i>					
Sacramento.....	Sacramento.....	73.5	21	69.4	- 4.1
<i>Connecticut.</i>					
Middletown *.....	Middlesex.....	70.9	29	74.4	+ 3.5
New Haven *.....	New Haven.....	71.8	101	74.5	+ 2.7
Thompson *.....	Windham.....	70.4	30	74.5	+ 4.1
Waterbury *.....	New Haven.....	72.8	12	70.9	+ 4.1
<i>Dakota.</i>					
Webster.....	Day.....	74.8	5	71.7	- 3.1
<i>Florida.</i>					
Archer.....	Alachua.....	77.2	5	75.4	- 1.8
<i>Illinois.</i>					
Collinsville.....	Madison.....	75.7	8	80.2	+ 4.5
Mattoon.....	Coles.....	77.9	7	81.5	+ 3.6
Peoria.....	Peoria.....	79.5	32	83.3	+ 4.7

Deviations from normal temperatures—Continued.

Station.	County.	Normal temperature for July.	Number of years.	Mean temperature for July, 1887.	Departure.
<i>Illinois—Continued.</i>		°		°	°
Riley.....	McHenry.....	70.4	26	75.1	+ 4.7
Rockford.....	Winnebago.....	72.1	14	75.6	+ 3.5
Sycamore.....	De Kalb.....	71.3	7	75.0	+ 3.7
<i>Indiana.</i>					
Blue Lick.....	Clark.....	76.6	10	81.4	+ 4.8
Connersville.....	Fayette.....	75.5	5	79.5	+ 4.0
Lafayette.....	Tippecanoe.....	74.7	20	79.8	+ 5.1
Logansport.....	Cass.....	77.5	33	81.8	+ 4.3
Mauzy.....	Rush.....	73.1	8	77.1	+ 4.0
Sunman.....	Ripley.....	78.3	4	81.9	+ 3.6
Vevay.....	Switzerland.....	78.7	21	81.1	+ 2.4
Worthington.....	Greene.....	73.3	10	79.9	+ 6.6
<i>Iowa.</i>					
Monticello.....	Jones.....	73.0	34	76.2	+ 3.2
<i>Kansas.</i>					
Independence.....	Montgomery.....	78.7	16	81.0	+ 2.3
Lawrence.....	Douglas.....	77.9	19	79.8	+ 1.9
Wellington.....	Sumner.....	77.8	9	81.3	+ 3.5
<i>Maine.</i>					
Belfast *.....	Waldo.....	66.4	28	67.6	+ 1.2
Cornish.....	York.....	70.9	30	72.7	+ 1.8
Gardiner *.....	Kennebec.....	68.7	51	70.4	+ 1.7
Orono *.....	Penobscot.....	67.7	19	71.0	+ 3.3
<i>Maryland.</i>					
Cumberland.....	Alleghany.....	73.6	16	77.7	+ 4.1
Fallston.....	Harford.....	74.7	13	79.7	+ 2.0
New Midway.....	Frederick.....	78.2	5	82.4	+ 4.2
<i>Massachusetts.</i>					
Amherst *.....	Hampshire.....	70.7	50	76.1	+ 5.4
Cambridge *.....	Middlesex.....	71.9	65	74.6	+ 2.7
Fitchburg *.....	Worcester.....	70.4	31	73.4	+ 3.0
New Bedford *.....	Bristol.....	69.6	74	71.8	+ 2.2
Somerset.....	Bristol.....	74.3	17	77.5	+ 3.2
Springfield *.....	Hampden.....	73.0	20	76.4	+ 2.8
Taunton *.....	Bristol.....	74.9	16	73.3	- 1.6
Westborough.....	Worcester.....	71.3	10	70.7	+ 5.4
<i>Nevada.</i>					
Carson City.....	Ormsby.....	71.5	8	71.5	0.0
<i>New Hampshire.</i>					
Concord *.....	Merrimac.....	70.7	19	73.7	+ 3.0
<i>New Jersey.</i>					
Dover.....	Morris.....	70.2	5	75.0	+ 4.8
South Orange.....	Essex.....	73.4	17	75.4	+ 2.0
<i>New York.</i>					
Factoryville.....	Tioga.....	69.0	6	74.5	+ 5.5
Ithaca.....	Tompkins.....	70.2	9	74.8	+ 4.6
Menands.....	Albany.....	71.3	5	75.7	+ 4.4
Palermo.....	Oswego.....	69.3	34	72.6	+ 3.3
<i>North Carolina.</i>					
Raleigh.....	Wake.....	80.0	4	82.0	+ 2.0
<i>Ohio.</i>					
North Lewisburg.....	Champaign.....	73.7	55	81.1	+ 7.4
Wauseon.....	Fulton.....	72.6	17	77.1	+ 4.5
<i>Pennsylvania.</i>					
Corry.....	Erie.....	67.3	7	73.7	+ 6.4
Dyberry.....	Wayne.....	68.3	20	72.6	+ 4.3
<i>South Carolina.</i>					
Stateburg.....	Sumter.....	79.3	7	79.3	0.0
<i>Texas.</i>					
New Ulm.....	Austin.....	82.7	16	83.3	+ 0.6
<i>Vermont.</i>					
Lunenburg *.....	Essex.....	67.9	38	74.2	+ 6.3
Newport *.....	Orleans.....	69.4	13	73.7	+ 4.3
Strafford.....	Orange.....	69.5	13	73.5	+ 4.0
<i>Virginia.</i>					
Bird's Nest.....	Northampton.....	79.2	19	84.0	+ 4.8
Dale Enterprise.....	Rockingham.....	75.1	7	83.0	+ 7.9
Variety Mills.....	Nelson.....	75.3	10	77.5	+ 2.2
Wytheville.....	Wythe.....	72.3	23	75.6	+ 3.3
<i>West Virginia.</i>					
Helvetia.....	Randolph.....	69.6	10	73.8	+ 4.2

* From the "Bulletin of the New England Meteorological Society."

The following notes are furnished by voluntary observers:

Arkansas.—Lead Hill, Boone Co.: the highest maximum temperature for July in the last five years, 109°, occurred during the present month; the lowest minimum temperature, 57°, in 1882.

Illinois.—Riley, McHenry Co.: the mean temperature for the present month, 75°, is the highest, with one exception, viz., July, 1868, which was warmer, that has occurred during the last twenty-six years.

Indiana.—Vevay, Switzerland Co.: the highest maximum temperature for July during the last twenty-one years, 105°, occurred during the present month; the lowest minimum temperature, 54°, in 1884 and 1876.

Iowa.—Monticello, Jones Co.: during the last thirty-four years the highest maximum temperature in July, 101°, was recorded in 1870, and the lowest minimum temperature, 43°, in 1863; the highest mean temperature for the same period, 82°, occurred in 1868, and the lowest mean temperature, 63°, in 1863.

Kansas.—Lawrence, Douglas Co.: the mean temperature for July, 1887, 80°, is, with two exceptions, viz., 85° in 1868, and 83° in 1874, the highest during the last nineteen years.

Wellington, Sumner Co.: during the last nine years the highest mean temperature for July, 81°, occurred during the present month; the highest July maximum temperature for the same period, 105°, occurred in 1879, 1884, and 1886; the lowest minimum temperature, 51°, in 1882.

Maryland.—Cumberland, Alleghany Co.: the highest mean temperature

for July in the last sixteen years, 78°, occurred during the present month, and the lowest mean temperature, 70°, in 1884; the highest maximum temperature for the same period, 98°, occurred also during the present month, and the lowest minimum temperature, 51°, in 1884.

Fallston, Harford Co.: during a period of thirteen years the highest mean temperature for July, 79°, occurred in 1872; the lowest mean temperature, 71°, in 1884.

Massachusetts.—Westborough, Worcester Co.: the mean temperature for the present month, 77°, is the highest July mean temperature, with one exception, viz., 79°, in 1876, that has occurred during the last twenty-one years.

New York.—Palermo, Oswego, Co.: during the last thirty-four years the highest mean temperature for July, 79°, occurred in 1868, and the lowest mean temperature, 63°, in 1860 and 1884.

Ohio.—Cleveland, Cuyahoga Co.: the mean temperature of the present month, 76°, has been exceeded but once, viz., 77°, in 1868, during the last thirty-three years.

North Lewisburg, Champaign Co.: since 1831 the maximum temperature has not been above 100° until the present summer; the maximum temperature for July, 1887, 102°, occurred on the 17th.

Wauson, Fulton Co.: during the last seventeen years the highest mean temperature for July, 77°, occurred during the present month; the lowest mean temperature, 68°, in 1882; the July extreme temperatures for the same period are: 104° in 1874 and 43° in 1871.

Pennsylvania.—Dyberry, Wayne Co.: during the last twenty years, the highest mean temperature for July, 74°, occurred in 1868; the lowest mean temperature, 61°, in 1884.

Texas.—New Ulm, Austin Co.: during the last sixteen years the highest maximum temperature for July, 104°, occurred in 1886; the lowest minimum temperature, 64°, in 1877.

Vermont.—Stratford, Orange Co.: during a period of sixteen years the highest mean temperature for July, 74°, occurred during the present month; the lowest mean temperature, 67°, in 1881.

Virginia.—Brunington, King and Queen Co.: the maximum temperature for the month, 98°, is about 4° higher than the maximum of the last seven years.

Variety Mills, Nelson Co.: the mean temperature for July, 1887, 78°, is the highest, with one exception, viz., 80° in 1878, that has occurred during the last ten years; the lowest mean temperature, 72°, occurred in 1882; the maximum temperature for the month, 101°, is the highest recorded since August, 1881.

Table of comparative maximum and minimum temperatures for July.

State or Territory.	Station.	For 1887.		Since establishment of station.				Length of record.
		Max.	Min.	Max.	Year.	Min.	Year.	
Alabama	Mobile	97.5	68.0	101.0	1883	63.8	1882	16
Do	Montgomery	100.4	70.4	105.9	1881	60.8	1882	14
Arizona	Yuma	114.0	66.1	118.0	1878	61.0	1879	11
Do	Fort Grant	96.5	57.4	100.9	1884	56.0	1880	8
Arkansas	Fort Smith	103.8	65.0	104.5	1884	61.0	1880	8
Do	Little Rock	100.0	64.2	101.3	1884	61.0	1882	8
California	Los Angeles	98.1	51.1	99.0	1884	50.4	1886	8
Do	San Francisco	69.9	49.0	83.0	1881, 1884	49.0	1874, 1881	16
Colorado	Denver	90.1	50.0	100.3	1874	42.0	1873	15
Do	Pike's Peak	54.8	28.6	64.0	1879	18.0	1870	13
Connecticut	New Haven	90.2	60.2	95.0	1876	50.3	1885	14
Dakota	Bismarck	95.6	50.3	102.0	1881	32.0	1884	12
Do	Deadwood	89.8	45.0	102.0	1881	42.0	1883	8
Dist. of Columbia	Washington City	100.8	64.5	108.0	1879	54.1	1885	16
Florida	Cedar Keys	92.1	66.9	94.0	1880, 1881	68.0	1886	7
Do	Pensacola	98.6	71.3	97.2	1884	64.2	1882	7
Georgia	Augusta	103.8	68.8	105.0	1878	61.7	1885	14
Idaho	Boise City	100.3	40.9	106.9	1880	40.0	1883	10
Illinois	Chicago	97.5	66.2	99.0	1874, 1881	60.0	1883	15
Do	Chicago	99.8	61.0	99.0	1874	50.0	1873	13
Indiana	Indianapolis	100.8	58.6	101.0	1881	47.5	1885	13
Do	Fort Mill	105.2	66.2	107.0	1884	50.0	1877, 1880	10
Iowa	Des Moines	100.6	54.6	101.0	1874	50.4	1882	14
Do	Des Moines	101.7	52.0	104.4	1880	39.0	1882	8
Kansas	Dodge City	99.4	58.2	108.0	1876	30.0	1877	12
Do	Leavenworth	101.7	57.1	104.0	1874	33.5	1882	14
Kentucky	Louisville	101.7	65.1	102.0	1874	54.0	1885	14
Louisiana	New Orleans	95.8	70.0	96.0	1877	59.8	1882	10
Do	Shreveport	103.8	69.0	107.0	1875	64.0	1877, 1884	14
Maine	Eastport	83.8	49.0	87.4	1886	45.0	1884	14
Do	Portland	83.8	52.7	97.0	1876	48.5	1886	15
Maryland	Baltimore	101.8	66.8	99.0	76, 79, 80	56.0	1885	15
Massachusetts	Boston	95.1	60.7	101.0	1880	46.0	1874	10
Michigan	Marquette	97.0	46.2	100.0	1878	38.0	1886	13
Minnesota	Grand Haven	89.7	52.0	90.0	1878	40.0	1873	14
Do	Saint Vincent	88.6	38.1	94.9	1886	39.2	1885	6
Mississippi	Saint Paul	98.9	51.3	100.0	1883	46.0	1873	14
Do	Vicksburg	95.3	68.4	100.0	1876	62.0	1881	14

Table of comparative maximum and minimum temperatures—Continued.

State or Territory.	Station.	For 1887.		Since establishment of station.				Length of record.
		Max.	Min.	Max.	Year.	Min.	Year.	
Missouri	Saint Louis	100.0	68.0	104.0	1881	57.0	1876	16
Montana	Fort Assinaboine	93.1	42.9	106.4	1886	35.0	1881	6
Do	Helena	91.5	43.5	103.1	1886	35.0	1880	7
Nebraska	North Platte	99.4	53.8	107.0	1877	45.0	1877, 1882	12
Do	Omaha	103.3	55.1	105.0	1874	51.0	1873	14
Nevada	Winnemucca	95.2	44.3	104.0	1877	37.0	1877, 1878	8
New Hampshire	Mt. Washington	66.0	30.4	72.0	1881	27.0	1883	13
New Jersey	Atlantic City	97.0	65.0	99.0	1880	53.0	1880	13
New Mexico	Santa Fe	86.8	51.0	95.5	1878	46.0	1872, 1880	14
New York	Buffalo	92.1	60.2	96.0	1878	47.5	1876	14
Do	New York City	94.0	65.8	99.0	1876	50.2	1885	16
North Carolina	Charlotte	102.2	65.6	101.0	1879	56.1	1885	8
Do	Wilmington	100.0	65.5	103.0	1879	62.0	1881	16
Ohio	Cincinnati	101.2	63.1	103.5	1881	53.0	1885	16
Do	Sandusky	96.0	62.9	96.0	1879	53.1	1885	9
Oregon	Portland	93.0	45.7	99.0	1885	40.0	1875, 1880	14
Do	Roseburg	93.1	39.6	100.8	1885	40.0	1879	10
Pennsylvania	Pittsburg	101.1	59.6	102.7	1881	50.0	1885	14
Do	Philadelphia	99.9	67.8	100.0	1876	56.0	1883	16
Rhode Island	Block Island	83.4	59.2	87.8	1885	55.0	1883	6
South Carolina	Charleston	97.9	69.8	104.0	1879	64.7	1886	14
Tennessee	Knoxville	100.2	65.2	100.0	1879	52.2	1885	16
Do	Memphis	99.0	67.3	99.0	1875, 1881	60.0	1882	14
Texas	Brownsville	91.6	65.1	98.0	1877, 1883	68.0	1877	11
Do	Fort Elliott	96.7	39.6	102.0	1881	49.0	1880	7
Utah	Salt Lake City	97.0	54.1	99.7	1885	45.0	1880	13
Virginia	Lynchburg	101.8	61.5	101.8	1881	54.4	1885	14
Do	Norfolk	102.5	65.3	102.5	1876	59.4	1885	16
Washington Ter.	Spokane Falls	94.2	41.4	100.3	1886	42.8	1884	6
Do	Olympia	86.2	39.6	97.0	1885	40.0	1882	8
Wisconsin	La Crosse	96.4	45.7	101.0	1874	32.0	1883	14
Do	Milwaukee	99.9	52.2	97.5	1886	49.7	1886	16
Wyoming	Cheyenne	89.5	46.0	100.5	1881	37.6	1882	14

FROSTS.

Saint Vincent, Minn.: the fall of temperature during the night of the 21st-22d caused general fears as to frost, but none occurred on this (the east) side of Red River; on the Dakota side of the river, however, light frosts were noticed in the vicinity of Bathgate and Hamilton, Pembina Co.; no damage was done to the staple crops, but cabbage, beets, onions, and potatoes were nipped. The minimum temperature at this station on the morning of the 22d was 38°.

Frosts are also reported to have occurred as follows:

Illinois.—Sycamore, 24th. Michigan.—Swartz Creek and Mackinaw City, 23d. Nevada.—Carson City, 14th, 22d. Oregon.—East Portland, 10th to 14th; Fort Klamath, 11th to 15th, 24th, 25th.

TEMPERATURE OF WATER.

The following table shows the maximum, minimum, and mean water temperature, as observed at the harbors of the several stations; the monthly range of water temperature; the average depth at which the observations were made, and the mean temperature of the air:

Temperature of water for July, 1887.

Station.	Temperature at bottom.				Mean temperature of the air at station.	Average depth of water, feet and tenths.
	Max.	Min.	Range.	Monthly mean.		
Canby, Fort, Wash.	64.3	61.1	3.2	63.0	55.0	13.6
Cedar Keys, Fla.	85.4	80.1	5.3	83.1	82.6	8.9
Charleston, S. C.	87.0	79.4	11.6	83.0	81.7	36.9
Eastport, Me.	51.0	46.4	4.6	48.6	60.9	16.7
Galveston, Tex.	89.2	83.0	6.2	86.1	82.9	
Key West, Fla.	90.4	84.4	6.0	87.8	82.7	21.6
New London, Conn.	70.8	64.7	6.1	67.1	73.2	12.5
New York City	80.3	70.9	9.4	75.6	76.7	
Pensacola, Fla.	88.3	77.3	11.0	83.3	81.8	18.4
Portland, Me.	65.0	54.4	10.6	59.3	70.1	17.5

* Record for twenty-six days.

PRECIPITATION (expressed in inches and hundredths).

The distribution of precipitation over the United States and Canada for July, 1887, as determined from the reports of about eight hundred stations, is exhibited on chart iii. In the table of miscellaneous meteorological data are given, for each

Signal Service station, the total precipitation, with the departures from the normal. The figures opposite the names of the geographical districts in columns for mean temperature, precipitation, and departures from the normal, show respect-

ively the averages for the several districts. The normal for any district may be found by adding the departure to the current mean when the precipitation is below the normal, and subtracting when above.

The rainfall for July, 1887, is excessive in the states bordering on the Atlantic and east Gulf coasts; also over an area extending from Minnesota and Dakota southwestward to the Pacific coast, and over portions of Texas, Montana, and Idaho. In the east Gulf states the average precipitation is 7.32, which is 2.30 more than the normal precipitation for that district; this large excess is due to the very heavy rains which fell in South Carolina, Georgia, and northern Florida, there being a deficiency in portions of Alabama and Mississippi. In the middle Atlantic states and New England the rainfall is about one inch more than the average amount for the month.

In the Lake region, central valleys, and in the northern and central Pacific coast regions, the rainfall is below the average. In the states of Missouri, Kansas, Iowa, Illinois, Michigan, Indiana, Ohio, and Kentucky, where drought prevailed during preceding months, the rainfall for July is below the average, the deficiency being greatest in the lower lake region, where less than one-half of the average amount of rain fell; a marked deficiency also occurs in the upper Mississippi valley, where the rainfall is but little more than half of the average.

The following are some of the most marked departures from the normal precipitation at Signal Service stations where the meteorological records cover ten, or more, years of observations:

Above normal.		Below normal.	
	Inches.		Inches.
Atlanta, Ga.	10.90	Springfield, Ill.	3.90
Pittsburg, Pa.	4.80	Omaha, Nebr.	3.81
Montgomery, Ala.	4.65	Leavenworth, Kans.	3.66
Augusta, Ga.	4.26	La Crosse, Wis.	3.27
Baltimore, Md.	3.76	Sandusky, Ohio.	3.23
Philadelphia, Pa.	2.92	Cleveland, Ohio.	3.20
Jacksonville, Fla.	2.88	San Antonio, Tex.	2.76
New York City	2.37	Dubuque, Iowa.	2.62

DEVIATIONS FROM AVERAGE PRECIPITATION.

The following table shows, for certain stations, as reported by voluntary observers, the average precipitation for the month of July for a series of years, the precipitation for July, 1887, and the departures from the average:

Station.	County.	Average pre- cipitation for July.	Number of years.	Precipitation for July, 1887.	Departure.
		Inches.		Inches.	Inches.
Arkansas.					
Lead Hill	Boone	7.85	5	1.82	- 6.03
California.					
Sacramento	Sacramento	0.01	21	0.00	- 0.01
Connecticut.					
Canton	Hartford	4.59	26	7.40	+ 2.81
Hartford	Hartford	4.44	16	3.20	- 1.24
Middletown	Middlesex	4.18	29	6.99	+ 2.81
Wallingford	New Haven	4.07	30	4.53	+ 0.46
Dakota.					
Webster	Day	6.30	5	4.73	- 1.57
Florida.					
Archer	Alachua	9.04	5	9.72	+ 0.68
Illinois.					
Collinsville	Madison	1.44	5	1.77	+ 0.33
Mattoon	Coles	2.89	7	1.30	- 1.59
Peoria	Peoria	3.50	32	2.85	- 0.65
Riley	McHenry	3.84	26	2.70	- 1.14
Rockford	Winnebago	4.07	14	3.12	- 0.95
Sycamore	De Kalb	4.93	7	3.12	- 1.81
Indiana.					
Blue Lick	Clark	2.84	6	1.00	- 1.84
Connorsville	Fayette	2.66	5	2.05	- 0.61
Lafayette	Tippecanoe	3.21	8	0.85	- 2.36
Logansport	Cass	3.90	33	2.95	- 0.95
Mauzy	Rush	2.35	8	0.69	- 1.66
Sunman	Ripley	2.44	4	2.03	- 0.41
Vevay	Switzerland	3.93	21	2.21	- 1.72
Worthington	Greene	4.00	5	2.30	- 1.70
Iowa.					
Cresco	Howard	4.62	15	3.11	- 1.51
Monticello	Jones	4.25	34	4.45	+ 0.20
Kansas.					
Independence	Montgomery	4.14	15	3.21	- 0.93
Lawrence	Douglas	4.37	19	2.14	- 2.23
Wellington	Sumner	4.14	9	3.45	- 0.69

Deviations from average precipitation—Continued.

Station.	County.	Average pre- cipitation for July.	Number of years.	Precipitation for July, 1887.	Departure.
		Inches.		Inches.	Inches.
Maine.					
Cornish	York	4.45	30	5.85	+ 1.40
Gardiner	Kennebec	3.82	49	6.97	+ 3.15
Orono	Penobscot	3.43	19	7.11	+ 3.68
Maryland.					
Cumberland	Alleghany	3.66	16	5.59	+ 1.93
Fallston	Harford	4.44	16	5.39	+ 0.95
New Midway	Frederick	3.66	6	6.21	+ 2.55
Massachusetts.					
Amherst	Hampshire	4.48	52	10.50	+ 6.02
Cambridge	Middlesex	3.47	46	4.18	+ 0.71
Chestnut Hill	Middlesex	3.60	12	3.69	+ 0.09
Framingham	Middlesex	3.41	13	3.81	+ 0.40
Lake Cochituate	Middlesex	4.25	36	3.67	- 0.58
Ludlow	Hampden	4.27	12	5.67	+ 1.40
Lynn	Essex	3.50	13	5.89	+ 2.33
Mystic Lake	Middlesex	4.02	12	6.43	+ 2.41
New Bedford	Bristol	3.34	71	3.61	+ 0.27
Somerset	Bristol	3.74	17	4.15	+ 0.41
Springfield	Hampden	4.38	40	6.61	+ 2.23
Taunton	Bristol	3.02	4	6.25	+ 3.23
Waltham	Middlesex	3.74	63	4.58	+ 0.84
Nevada.					
Carson City	Ormsby	0.27	8	0.23	- 0.04
New Brunswick.					
Saint John	Saint John	4.01	27	5.60	+ 1.59
New Hampshire.					
Concord	Merrimac	3.90	32	7.84	+ 3.94
New Jersey.					
Dover	Morris	4.33	5	10.02	+ 5.69
South Orange	Essex	4.60	17	9.38	+ 4.78
New York.					
Factoryville	Tioga	4.34	6	7.19	+ 2.85
Palermo	Oswego	3.20	34	2.65	- 0.55
North Carolina.					
Raleigh	Wake	3.20	4	9.10	+ 5.90
Ohio.					
North Lewisburg	Champaign	4.65	15	2.20	- 2.45
Wauseon	Fulton	4.05	15	2.87	- 1.18
Pennsylvania.					
Dyberry	Wayne	5.00	16	9.28	+ 4.28
Rhode Island.					
Providence	Providence	3.46	56	6.09	+ 2.63
South Carolina.					
Kirkwood	Kershaw	4.63	20	4.13	- 0.50
Stateburg	Sumter	3.58	7	4.90	+ 1.32
Texas.					
New Ulm	Austin	4.23	16	2.76	- 1.47
Vermont.					
Lunenburg	Essex	3.98	38	4.88	+ 0.90
Newport	Orleans	4.46	13	6.15	+ 1.69
Stratford	Orange	4.37	13	5.60	+ 1.23
Virginia.					
Bird's Nest	Northampton	4.59	19	5.60	+ 1.01
Dale Enterprise	Rockingham	3.74	7	7.05	+ 3.31
Variety Mills	Nelson	3.36	8	5.15	+ 1.79
Wytheville	Wythe	4.11	23	5.58	+ 1.47
West Virginia.					
Helvetia	Randolph	7.04	10	2.86	- 4.18

* From the "Bulletin of the New England Meteorological Society."

The following notes on precipitation are furnished by voluntary observers:

Arkansas.—Lead Hill, Boone, Co.: during the last five years the greatest precipitation for July, 11.60, occurred in 1883; the least, 1.82, was recorded during the present month.

Indiana.—Vevay, Switzerland Co.: the largest July precipitation during the last twenty-one years, 9.80, occurred in 1874; the least, 0.90, in 1869.

Iowa.—Monticello, Jones Co.: the greatest precipitation for July during the last thirty-four years, 10.93, occurred in 1883; the least, 0.60, in 1874.

Kansas.—Independence, Montgomery Co.: during the past fifteen years the greatest precipitation in July, 10.22, occurred in 1875, and the least, 0.39, in 1874; the total precipitation for the seven months ending July 31st, 1882, is 4.95 less than the average of the same months in the above-mentioned period.

Lawrence, Douglas Co.: the total precipitation for the seven months ending July 31st, 1882, is 5.15 below the average for the same months in the nineteen preceding years.

Maryland.—Cumberland, Alleghany Co.: in the last sixteen years the greatest precipitation for July, 5.59, occurred during the present month; the least, 1.01, in 1885.

Fallston, Harford Co.: the greatest precipitation for July during the last sixteen years, 10.03, occurred in 1886; the least, 1.42, in 1881.

Massachusetts.—Amherst, Hampshire Co.: the total precipitation for the month, 8.93, is the largest during any month of July since 1839, when it was 9.56; in 1863 it was 8.63, the next highest amount.

Ohio.—Wauseon, Fulton Co.: during the last fifteen years the greatest precipitation for July, 7.26, occurred in 1872; the least, 0.31, in 1886.

New York.—Palermo, Oswego Co.: the greatest precipitation for July during the last thirty-four years, 6.60, occurred in 1874; the least, 0.64, in 1882.

Pennsylvania.—Dyberry, Wayne Co.: the total precipitation for July, 1887, 9.28, is the largest amount recorded for any month during the last twenty years; the least precipitation for July in that time, 1.70, occurred in 1885.

South Carolina.—Stateburg, Sumter Co.: the greatest precipitation for July during the past seven years, 5.67, occurred in 1885; the least, 1.70, in 1884.

Texas.—New Ulm, Austin Co.: during the last sixteen years the greatest July precipitation, 14.38, occurred in 1878; no rain fell in July, 1884.

Vermont.—Strafford, Orange Co.: the largest July precipitation during the last thirteen years, 6.10, occurred in 1880; the least, 2.00, in 1881.

Virginia.—Variety Mills, Nelson Co.: during the last eight years the greatest July precipitation, 5.15, occurred during the present month; the least, 1.68, in 1883.

Table of excessive and greatest monthly precipitation for July, 1887.

Station.	Specially heavy.		Largest monthly.	Station.	Specially heavy.		Largest monthly.
	Date.	Amt.			Date.	Amt.	
<i>Alabama.</i>				<i>Louisiana—Con.</i>			
Opelika.....	20	2.96	20.15	Natchitoches.....			7.11
Do.....	23, 24	2.98		Grand Coteau.....			6.63
Do.....	27, 28	11.20		<i>Maine.</i>			
Greenville.....	23	3.44	10.33	Orono.....	22 to 25	4.38	7.11
Do.....	27, 28	3.07		Gardiner.....	23, 24	5.11	6.96
Eufaula.....	27	2.65	9.15	Mayfield.....			6.33
Fort Deposit.....	27 to 31	6.19	9.11	Cornish.....	23, 24	3.08	
Montgomery.....	27, 28	2.46	8.56	<i>Maryland.</i>			
Evergreen.....	6, 7	2.33	6.81	Baltimore.....	21	2.76	8.32
Mount Vernon.....	5	2.40	6.01	Fort McHenry.....			6.26
<i>Arizona.</i>				New Midway.....	23, 24	2.08	6.21
Fort Grant.....			9.00	Cumberland.....	23	3.00	
<i>Arkansas.</i>				Fallston.....	5	2.19	
Tucson.....	7 to 9	2.91		<i>Massachusetts.</i>			
<i>California.</i>				Boyd's Corners.....			13.55
Forrest City.....	7	2.00	8.70	Williamstown.....	23, 24	5.76	10.82
Do.....	20, 21	4.30		Deerfield.....	23, 24	6.41	10.66
Hot Springs.....	5, 6	2.50		Amherst a.....			10.50
Helen.....	8	2.50		Dudley.....	17, 18	3.62	10.49
Pine Bluff.....	20, 21	2.30		Do.....	23, 24	3.40	
<i>Colorado.</i>				Amherst b.....	23, 24	5.79	8.93
Fort Lewis.....	9, 10	2.38	7.54	Northampton.....			8.91
Do.....	13, 14	2.64		Chicopee.....			8.24
Pike's Peak.....			6.53	Princeton.....			7.27
<i>Connecticut.</i>				Fitchburg a.....			7.23
Canton.....			7.40	Fitchburg b.....			7.09
Middletown.....			6.99	Springfield.....			6.61
North Colebrook.....	23, 24	5.05	6.65	Mystic Lake.....			6.43
Voluntown.....	17	2.10		Taunton a.....			6.29
New Haven.....	21, 22	2.16		Monson.....			6.27
<i>Dakota.</i>				Taunton b.....			6.25
Parkston.....	1, 2	2.39		Taunton c.....			6.20
Henry.....	1, 3	2.48		Graton.....			6.09
Fort Sisseton.....	1, 2	2.26		Gilbertville.....			6.06
<i>Florida.</i>				Rove.....			6.05
Limons.....	29, 30	8.64	12.50	<i>Mississippi.</i>			
Tallahassee.....	6, 7	2.70	12.45	Moorhead.....			6.40
Do.....	27	2.35		<i>Missouri.</i>			
Do.....	30, 31	2.00		Lamar.....			7.10
Manatee.....	1	2.96	10.15	New Hampshire.			
Do.....	30, 31	3.39		Manchester.....			15.16
Archer.....	5, 6	2.91	9.72	Nashua.....	23, 24	5.40	9.54
Do.....	29 to 31	3.85		Concord a.....			7.85
Cedar Keys.....	23, 24	2.90	9.40	Concord b.....	23, 24	4.65	7.52
Jacksonville.....	29	2.88	8.49	Berlin Mills.....			7.28
Live Oak.....			7.30	Grafton.....			7.18
Fort Meade.....	29	2.90	6.75	Manchester b.....	23, 24	5.17	7.14
<i>Georgia.</i>				West Milan.....			6.92
Union Point.....	28 to 30	16.50	18.13	Lake Village.....	22 to 24	4.03	6.83
Milledgeville.....	16, 17	3.28	16.09	Woodstock.....	22 to 25	3.12	6.70
Do.....	28 to 31	9.58		Antrim.....	21 to 24	3.71	6.10
Washington.....	28 to 31	11.91	13.95	Wolfsborough.....	24	3.58	6.09
Athens a.....	28 to 31	12.63	13.93	Bristol.....	24	2.67	6.08
Newnan.....	27 to 31	9.93	13.93	Walpole.....			6.05
Athens b.....	28 to 31	10.78	14.47	Wier's Bridge.....	22 to 24	3.15	
Griffin.....	28 to 31	9.20	14.44	<i>New Jersey.</i>			
Atlanta.....	28 to 30	8.09	14.11	Hightstown.....	23	4.03	15.29
Smithville.....	4 to 6	3.79	13.01	Mattawan.....	22	5.40	14.00
Do.....	27 to 31	2.30	13.71	Dover.....	5, 6	3.74	10.02
Milledgeville.....	23, 24	3.40		Do.....	23, 24	3.77	
Do.....	29 to 31	3.67		Rancocas.....	23	3.50	9.90
Forsyth.....	27 to 31	9.35	13.70	Somerville.....	21	3.01	9.83
Columbus.....	27 to 28	5.80	13.59	Paterson.....	23	4.86	9.83
Do.....	30, 31	2.15		Beverly.....	27	3.46	9.48
West Point.....	27, 28	6.55	13.26	South Orange.....	21 to 23	6.10	9.38
Do.....	29, 30	3.65		Gillette.....	25	4.27	9.31
Toccoa.....	28 to 31	3.27	11.66	Union.....	24	3.56	9.29
Cartersville.....	28 to 31	4.39	10.54	Roseland.....	23	3.35	9.17
Bainbridge.....	27	2.30	10.43	Locktown.....			8.86
Do.....	31	2.10		Lambertville.....			7.92
Quitman.....	27, 28	2.25	9.24	Bordentown.....	24	2.52	7.90
Alapaha.....	4 to 6	3.34	9.69	Elizabeth.....	22	2.45	7.71
Eastman.....	5, 6	3.07	9.37	Newark.....			7.05
Do.....	28, 29	3.00		Oceanic.....	26	2.52	6.95
Thomasville.....	26, 27	3.62	9.37	Imlaystown.....			6.81
Do.....	31	2.78		New Brunswick.....			6.20
Waynesborough.....	21	2.46	8.87	Moorestown.....			6.59
Do.....	29, 30	2.28		Hopewell.....			6.05
Augusta.....	29	4.58	8.83	<i>New York.</i>			
Jennip.....	5, 6	2.25	7.74	Fort Columbus.....	23, 24	2.94	8.36
Do.....	29	2.10		Brooklyn.....	23, 24	2.36	7.47
Gainesville.....	28	3.10	7.28	West Point.....			7.44
Fort Gaines.....	27	2.80	6.90	Factoryville.....	23, 26	3.35	7.19
Macin.....	28 to 30	3.07	6.41	Auburn.....	23, 24	2.07	6.97
<i>Kansas.</i>							
W. Leavenworth.....	20, 21	2.90					
<i>Louisiana.</i>							
Monroe.....	11, 12	2.82	12.27				
New Orleans.....			7.85				
Coushatta.....	6, 7	3.90	7.60				

Table of excessive and greatest monthly precipitation for July—Cont'd.

Station.	Specially heavy.		Largest monthly.	Station.	Specially heavy.		Largest monthly.
	Date.	Amt.			Date.	Amt.	
<i>New York—Con.</i>				<i>South Carolina.</i>			
White Plains.....	21 to 24	3.56	6.91	Blackville.....	7, 8	2.19	13.62
New York City.....	23, 24	2.86	6.75	Do.....	19, 20	2.60	
Setauket.....	24	2.27		Do.....	29, 30	3.70	
<i>North Carolina.</i>				Yemassee.....	23	2.23	13.03
Tarborough.....	4, 5	5.14	11.53	Do.....	29, 30	4.62	
Do.....	28 to 30	3.63		Ratesburg.....	20	2.97	21.19
Raleigh a.....	7	4.90	9.10	Do.....	29, 30	2.75	
Davidson College.....	6, 7	3.05	8.38	Allendale.....	19, 20	2.47	9.42
Wake Forest.....	8, 9	2.08	8.34	Do.....	28, 29	2.49	
Do.....	19 to 23	4.96		Abbeville.....			9.12
Charlotte.....			7.46	Hampton.....			9.12
Wadesborough.....	21, 22		7.40	Saint George's.....	29, 30	3.20	8.56
Wilmington.....	3, 4	3.62	6.77	Holland's Store.....			8.48
Raleigh b.....	8	2.40	6.68	Greenwood.....			8.13
Statesville.....	6 to 8	3.95	6.54	Do.....	4, 5	3.13	7.94
Goldaborough.....	4	3.10	6.42	Hardesville.....	29, 30	2.58	
Weldon.....	4	3.31	6.27	Cheraw.....	27, 28	2.45	7.88
Salisbury a.....			6.26	Newberry.....			7.86
Hatteras.....	4, 5	2.42	6.18	Charleston.....			7.74
Raleigh c.....	7, 8	3.17	6.11	Anderson.....	29 to 31	6.98	7.68
Salisbury b.....	7	3.00	6.03	Belfast.....			7.10
New-Berne.....	4, 5	3.55	6.01	Winnabow.....			6.99
Lenoir.....	19	2.80		Saint Matthew's.....	29, 30	3.68	6.84
Reidsville.....	8	2.30		Chester.....	6, 7	3.08	5.74
Marion.....	20, 21	2.84		Do.....	29, 30	2.07	
<i>Pennsylvania.</i>				Bonnettsville.....			6.70
Easton.....	5, 6	3.11	11.28	Spartanburg.....	21	3.58	6.66
West Chester.....	5	3.04	11.37	Branchville.....	29, 30	2.37	6.37
Do.....	23	3.81		Florence.....			6.45
Blooming Grove.....	21	4.20	10.98	Columbia.....			6.04
Do.....	23, 24	2.60		Stateburg.....	29, 30	2.60	
Germantown.....	24	3.45	10.84	<i>Texas.</i>			
Pittsburg.....	20, 21	3.85	9.51	Columbia.....	1, 2	6.60	8.73
Dyberry.....	21	3.00	9.28	Wiemar.....	2, 3	3.40	
Do.....	24	2.13		Tyler.....	4, 5	3.50	
Fallsington.....	22 to 24	5.04	9.28	Dallas.....	5	3.00	
Quakertown.....	5	3.20	9.25	Fort Davis.....	10	2.69	
Do.....	31	2.35		<i>Vermont.</i>			
Wilkesbarre.....	21, 24	3.50	8.76	Townshend.....			8.55
Bethlehem.....	5, 6	4.80	8.58	Jacksonville.....			7.11
Philadelphia.....	23	2.75	7.14	Marlborough.....			6.38
Wellsborough.....	22	2.10	7.03	Newport.....	25	2.35	6.15
Do.....	25, 26	4.15		Vernon.....			6.18
Phillipsburg.....			6.40	<i>Virginia.</i>			
Drifton.....	28	2.51		Dale Enterprise.....			7.05
Rending.....	21	2.50		Cape Henry.....			6.21
<i>Rhode Island.</i>				Brington.....	5, 6	2.25	
Block Island.....	20	3.40	7.52	Wytheville.....	23	2.62	
Providence.....			6.09	<i>Wisconsin.</i>			
				Embarras.....	3	2.00	
				Madison.....	1, 2	2.40	
				Milwaukee.....	2	2.98	

* Record for 24 days.

SLEET.

The observer at Pike's Peak, Colo., reports sleet to have fallen during the month on the following dates, 8th, 16th, 30th. No other station reported sleet.

HAIL.

Under the heading "Local storms" will be found descriptions of the more severe hail storms which have occurred during the month. In addition to these, hail was reported to have fallen in the various states and territories as follows:

Arizona.—Whipple Barracks, 4th.

Arkansas.—Lead Hill, 31st.

California.—Fort Bidwell, 28th.

Colorado.—Montrose, 2d; Pike's Peak, 4th to 6th, 8th, 17th, 18th, 31st; Colorado Springs, 21st.

Dakota.—Webster, 8th; Deadwood, 11th, 25th; Fort Meade, 21st, 31st; Huron, 23d; Fort Randall, 26th; Forts Totten and Abraham Lincoln, 29th.

Florida.—Fort Meade, 19th.

Idaho.—Fort Sherman, 25th.

Illinois.—Pekin, 1st, 4th; New Burnside, 19th.

Indiana.—Logansport, 18th.

Iowa.—Des Moines and Muscatine, 17th; Independence, 21st.

Kansas.—Ninnescah, 2d; Concordia, 2d, 21st; Leavenworth, 5th; Wellington, 10th.

Maryland.—Baltimore, 18th.

Minnesota.—Saint Paul, 8th.

Nebraska.—Genoa, 21st; Valentine, 23d.

New Mexico.—Fort Union, 5th, 24th.

North Carolina.—Charlotte, 19th.

Pennsylvania.—Erie, 3d; Quakertown, 16th, 31st; Pittsburgh, 31st.

South Carolina.—Spartanburg, 19th, 21st.

Texas.—Cleburne, 5th; Fort Davis, 16th.

Utah.—Frisco, 14th.

Vermont.—Strafford, 3d; Charlotte, 28th.

Virginia.—University of Virginia, 17th; Marion, 19th.

Wyoming.—Cheyenne, 3d, 19th, 25th; Camp Sheridan, 6th, 21st; Fort Washakie, 21st; Fort Laramie, 22d.

DROUGHT.

From the reports given under this heading it will be seen that the severe drought, which began in previous months in several of the Western States, has continued during July. This protracted drought has, in many sections, so blighted some of the staple crops that at the close of the month rains would have benefited them but little.

Concerning the drought of July, the following notes are given:

Alabama.—Mobile, 19th: the weather is very dry and dusty, and rain very much needed.

Colorado.—Denver, 15th: the heavy rain which began yesterday continues unabated to-day. The rain is general over the state, and the streams are full of water. This will end the drought in sections which have suffered, and insure bountiful crops.

Sterling, Weld Co., 15th: two heavy rain storms have visited this locality during the past week. Crops and vegetation of all kinds are doing remarkably well.

Dakota.—Fort Sully, 13th: farmers state that the extremely dry weather has done considerable injury to crops.

Parkston, Hutchinson, Co., 31st: the rain during the month in this vicinity has been unevenly distributed; while in some places the rains have been abundant, in others only a few miles distant but little rain has fallen.

Illinois.—The "Chicago Tribune" of July 16th contains reports from about forty localities in various parts of Illinois showing that drought of more or less severity was general throughout the state. On the 23d reports from generally the same places, and to the same paper, indicated that, while in some localities copious rains had fallen, practically the drought remained unbroken.

The Chicago "Morning News" of July 18th states that "the present drought is a severe blow to the farmers and stock raisers of Illinois and other portions of the dry section. They have already begun to compare it with that of the ruinous season of 1881. Until two weeks ago the prospect for a heavy corn crop was never better. But now is the critical time. The terrific heat of the sun, burning day after day from an almost cloudless sky, and the short nights that bring no dew, have nearly destroyed the farmers' hopes. In many sections the corn is dying in the fields. Every day of dry weather represents a loss of many thousands of dollars to the farmers of this and neighboring states."

Greenville, Bond Co., 21st: a heavy rain fell here this afternoon, ending, it is hoped, the dry spell which has lasted for over a month. It comes in time to help late corn, but it is feared the early crop is blighted beyond saving.

Xenia, Clay Co., 21st: after a long drought and two weeks of excessively hot weather, one of the heaviest rains of the season fell at 6 o'clock this evening. It descended in torrents, thoroughly saturating the ground. Had this rain not come until a few days later the corn would have been burned up.

Chatham, Sangamon Co., 21st: the long drought was broken, and the corn crop in this section saved, by the copious rainfall of last night. The drought has caused a scarcity of water and ruined the pastures and fruit crop in this vicinity, but it is thought the corn crop will be saved.

Centralia, Marion Co., 21st: the weather here has been oppressive for the past twenty days. Everything in the way of vegetable life is parched and practically ruined. The first rain in fifty days occurred on the afternoon of this date.

The "Chicago Times" of the 26th states that in Henry county the farmers have disposed of their stock at great sacrifice, on account of poor pasturage and scarcity of feed.

Charleston, Coles Co., 31st: July has been extremely hot and dry; the pastures in this township have entirely failed, and corn has been damaged about 75 per cent.

Mattoon, Coles Co., 31st: the drought in this locality is growing serious; vegetation of all kinds has been seriously injured.

Riley, McHenry Co., 31st: the drought still continues; the hay crop has been nearly ruined; wheat and oat crops are very light; corn is at least two weeks more advanced than usual, but is suffering for rain.

Sandwich, DeKalb Co., 31st: the month has been intensely hot and dry; meadows in many sections are completely dry, and pastures have failed.

Windsor, Shelby Co., 31st: the drought is very severe; pastures are failing; wells that never failed before are becoming dry, and cattle are suffering on account of insufficient water.

Indiana.—Huntington, Huntington Co., 29th: extremely dry and hot weather continues in this section. Many farmers report that even though rain should fall at this time the corn crop would be short. Grass is dying, and in some localities stock are suffering from want of water.

Wabash, Wabash Co., 29th: reports received to-day from the Eel River Valley district, in the northern part of this county, indicate that the corn is actually burning up from the excessively hot weather and long-continued drought. This is usually the most fertile district in the county. Eel River has not been so low in twenty-five years, and mills supplied by it are obliged to suspend operations.

Laconia, Harrison Co., 31st: but 0.62 inch of rain has fallen at this place since June 9th; the drought is considered the severest ever experienced; all crops have suffered, and some are nearly complete failures.

Terre Haute, Vigo Co., 31st: the drought has caused much injury to the growing crops in this county.

Iowa.—Independence, Buchanan Co.: the rain of the 18th was of great benefit to the crops, which were suffering from effects of drought.

Carson, Pottawattamie Co., 31st: drought continues in this section; corn is suffering seriously, and pastures have dried up.

Hamburg, Fremont Co., 22d: crops in this vicinity are suffering on account of drought.

McGregor, Clayton Co., 22d: the recent rains have greatly benefited crops in this county.

New Hampton, Chickasaw Co., 22d: on account of drought, only about one-third of the average crop of hay will be produced.

Dubuque, 25th: the drought in this section of the state is very severe; the fruit and potatoes will be a complete failure; corn has sustained some damage; in exposed places the ground is perfectly dry and the grass dead; no rain of any consequence fell in twenty-two consecutive days, during which time the temperature was unusually high.

Fort Madison, Lee Co., 31st: the month has been the driest ever known here; the pastures are drying up, and farmers had to feed their stock on hay. Crops are suffering; unless rain falls soon they will prove a failure.

Cedar Rapids, Linn Co., 31st: Cedar River is lower than known for at least ten years, and there is very little feed and water in the pastures for stock.

Oskaloosa, Mahaska Co., 31st: the month has been hot and dry and the pastures are burned brown; within the past few days the corn crop has failed rapidly, and unless rain falls soon there will be but half a crop.

Des Moines, 31st: on account of the protracted drought which has prevailed in this section, all crops have been so injured that should rain now fall they would not be benefited; wells and many small rivers have become dry.

Kansas.—Manhattan, Riley Co., 15th: crops are suffering for rain, and wells and creeks are becoming dry.

Leavenworth, 17th: the continuous hot and dry weather is very damaging to crops; the corn crop will prove a failure unless rain falls soon.

Wellington, Sunman Co.: drought prevailed from the 18th to 31st and streams and ponds became very low; on the 31st 0.40 inch of rain fell.

Independence, Montgomery Co., 30th: all vegetation is suffering from the effects of drought; corn is much injured.

Parsons, Labette Co., 30th: a drought has prevailed here since July 4th. On that day rain fell nearly all day in torrents, since which time scarcely a drop has fallen; although the ground was thoroughly soaked by the rain of the 4th and the corn well advanced, the dry weather which has prevailed since shows a damaging effect upon it; while the early planted corn is beyond injury by drought, there are thousands of acres that were planted after the wheat had been harvested which will now be so retarded in its growth as to make it worthless for anything more than heavy fodder.

Salina, Saline Co.: the month of July has been unusually hot and dry, and crops are suffering greatly in consequence.

Wakefield, Clay Co., 31st: at the close of the month drought continues; farmers are generally cutting up their corn for fodder; this crop is considered a failure in Clay county, except in a few localities. Reports from other counties in this part of the state show that the drought has been even more severe than in this county.

Topeka, 31st: the large deficiency in rainfall and the intensely hot and dry winds have seriously impaired the growth of all crops. Over large areas farmers are cutting the corn to save the fodder, the ears being shriveled; the hay had to be cut three weeks earlier than usual in order to save it.

Ninnescah, Kingman Co.: although 2.66 inches of rain has fallen at this place the month may be considered dry, as much the greater part of the total rainfall occurred on the 2d. The excessive heat during the month caused great injury to all crops in this and adjoining counties.

Elk Falls, Elk Co., 31st: the month has been very hot and dry, and the corn crop has suffered seriously in consequence; wells are failing and springs becoming dry; cattle have to be driven long distances for water.

East Norway, Doniphan Co., 31st: drought has caused much injury to the corn crop in some localities in this county, while in others the crop looks well.

Maryland.—Reports from Oakland, Garrett Co., on the 17th to "The (Baltimore) Sun," state that when rain fell a week ago it was generally supposed that the severe drought had been broken, but before the end of the week all traces of rain and moisture had passed away, and Garrett county was suffering as much from want of rain as at any time during the season. The North Branch of the Potomac is nearly dry, where it is crossed by the Baltimore and Ohio Railroad at Bloomington, in this county.

Michigan.—Battle Creek, Calhoun Co., 22d: on account of the continued dry weather corn, potatoes, and grass are suffering seriously.

Kalamazoo, Kalamazoo Co.: the hot and dry weather of July has been destructive to corn and other crops. The severe drought which prevailed in this region in 1868 is considered to have been less severe than the drought of July, 1887.

Thornville, Lapeer Co., 31st: wheat and hay are the only good crops of the season; all spring and summer crops were more or less injured by the hot and dry weather.

Swartz Creek, Green Co., 31st: the month has been very hot and dry; nearly two-thirds of the rain fell on the first four days of the month, and none fell after the 9th; pasturage is very poor, and crops in general have suffered great injury.

Hudson, Lenawee Co., 31st: a protracted drought is prevailing in this locality; with one exception, no rain has fallen since the 9th, viz., 0.30 inch on the 21st; although hay, wheat, and oats gave a fair yield, corn and potatoes have suffered seriously from the drought.

Mottville, Saint Joseph Co., 31st: on account of the protracted dry weather all streams in this vicinity are very low.

Birmingham, Oakland Co.: the severest drought that has ever been known here prevailed during July; crops of corn and peas in many fields have dried up completely, and the farmers are cutting the corn stalks for feeding; notwithstanding the protracted drought in this neighborhood, excessive local rains have fallen in places from six to fifteen miles south of this station, and have caused destruction to corn and potatoes.

The "Michigan Crop Report," August 1, 1887, states:

The drought that has prevailed in the southern part of the state, with scarcely a break during the entire season, has injured corn and potatoes beyond the hope of recovery. * * * In many localities corn is being cut and either fed to stock or cured for winter fodder. In the central and southern counties the outlook for corn and potatoes is more favorable, though in these sections both crops will be far below the average.

Nebraska.—Tecumseh, Johnson Co., 31st: drought continues; the corn and potato crops will be short fully fifty per cent.

Brownville, Nemaha Co.: the month has closed with a severe drought; corn and all vegetation are dried up; the grass is dead, and the ground in places is dry to a depth of two feet. The protracted drought of the present season is more severe than any previous drought in this locality.

New York.—Amboy, Oswego Co., 4th: drought is causing injury to all crops in this county.

Palermo, Oswego Co., 4th: crops in this vicinity are suffering from the effects of drought.

Factoryville, Tioga Co.: up to the 17th all vegetation suffered from the effects of drought; during the 17th and 18th more than one inch of rain fell.

North Carolina.—Raleigh, 23d: it is reported that crops have been injured by the intense heat in the central part of the state; tobacco and cotton have sustained some injury.

Ohio.—Yellow Springs, Greene Co., 31st: the drought which prevailed in June has continued throughout July. Farmers report that corn will yield but half a crop. The pastures are dry; in some places cattle are fed as in winter.

Tiffin, Seneca Co., 31st: the drought during July was unusually severe; pastures have failed and corn in many places has dried up completely. On the 30th 0.53 inch of rain fell, but it was not sufficient to break the drought.

Tennessee.—Ashwood, Maury Co., 31st: the weather is very hot and dry; rain is much needed. In this vicinity corn will not yield more than half a crop.

Texas.—San Antonio, Bexar Co., 27th: reports from Frio county state that the water-holes are drying up rapidly and that cattle are dying of thirst.

Palestine, Anderson Co., 31st: no rain fell in this section of the state during the latter half of the month and the weather has been very hot; the cotton crop on sandy soil in this county is almost ruined. At the middle of the month the prospect for cotton was the best for years, but from the present outlook the yield will not be more than one-half of the average, and if no rain falls during the first ten days of August the crop will be a complete failure.

Virginia.—Lynch's Station, Campbell Co., 31st: both the corn and tobacco crops in this vicinity are in need of rain, and unless it comes soon these crops will be short.

West Virginia.—Middlebrook, Randolph Co., 31st: the precipitation during the month was unusually small; many of the springs are dry, and the pastures and meadow lands are very much parched from the effect of drought.

Wisconsin.—Milwaukee, 15th: the "Evening Wisconsin" of this date states that very severe drought prevails in the counties of Fond du Lac, Winnebago, Green Lake, Marquette, Dodge, and Columbia; that the vegetation over open prairies is literally burned up, and the marshes and beds of creeks are completely dry.

Embaras, Waupaca Co., 31st: on account of severe drought wells are failing and the rivers are very low.

WINDS.

The most frequent directions of the wind during July, 1887, are shown on chart ii by arrows flying with the wind. In the central and southern portions of the country to the eastward of the Rocky Mountains and in New England the prevailing winds were generally from southeast to southwest; in the extreme northwest they were from the northeast to northwest; in the Lake region, Rocky Mountain districts, and on the Pacific coast they were variable.

HIGH WINDS (in miles per hour).

Wind-velocities of fifty or more miles per hour (on mountain stations at or exceeding seventy miles), other than the maximum velocities for the month, which are given in the table of miscellaneous data:

Valentine, Nebr., 54, nw., 28th.

Mount Washington, N. H., 75, sw., 6th; 72, nw., 14th.

LOCAL STORMS.

Milwaukee, Wis.: a thunder-storm began at 1.45 and ended at 9.40 p. m. on the 2d; from 3 to 6 p. m. the rainfall amounted to 1.76 inches; considerable damage was done by the overflowing of sewers, etc., in the lower portions of the city. The electrical discharges were terrific and almost constant during the afternoon.

Baldwinsville, Onondago Co., N. Y.: a hail storm occurred at this place on the afternoon of the 2d, causing considerable damage to the tobacco crop.

Fulton, Oswego Co., N. Y.: buildings and trees were blown down by a storm which occurred at Gilbert's Mills, a few miles east of Fulton, at about 5.30 p. m. on the 2d.

Elmira, Chemung Co., N. Y.: at about 4 p. m. on the 2d a severe hail storm passed over the village of Wellsburg and vicinity, about six miles east of Elmira. The storm is reported to have been the severest ever experienced in that vicinity, and caused damage estimated at \$20,000.

Easton, Aroostook Co., Me.: during the afternoon of the 5th a very heavy rain storm occurred at this place. A wash-out occurred on the Bangor and Portland Railroad, and several small bridges were washed away. The damage is estimated at \$20,000.

Leavenworth, Kans.: During the thunder-storm on the 5th heavy hail fell from 2.06 to 2.11 p. m.; the hail-stones were of various shapes, varying in size from one-half inch to two and one-half inches in circumference.

Poughkeepsie, Dutchess Co., N. Y.: during the afternoon of the 6th a violent thunder-storm occurred in the Hudson River Valley; the heavy rainfall caused washouts on the railroads, and basements and cellars of numerous buildings were flooded.

Allentown, Lehigh Co., Pa.: an unusually severe storm occurred in the Lehigh Valley during the afternoon of the 6th; lightning and the very heavy rainfall caused much damage.

Reading, Berks Co., Pa.: the storm of the 6-7th caused a large amount of damage in this section. Numerous buildings were struck by lightning.

Saint Vincent, Minn.: at 2.55 p. m. on the 8th a gale set in, and was followed at 2.56 p. m. by a heavy rain storm; the most violent part of the storm occurred about 3 p. m., and it ended at 3.45 p. m. The course of the storm was from northwest to southeast. A considerable quantity of wheat and barley was beaten down by the heavy rain.

Cambridge, Dorchester Co., Md.: two very heavy rain storms occurred at this place and in the surrounding country on the 9th. In many places the corn fields were submerged, and numerous bridges on the public roads were washed out.

Mr. W. H. Hill, a voluntary observer at Palo Alto, Miss., reports that a violent thunder-storm occurred at that place on the afternoon of the 10th; the electrical display was remarkable; three miles southwest of Palo Alto, over a small area of two acres, about one hundred large trees were struck by lightning.

Rev. C. Foster Williams, voluntary observer at Ashwood, Maury Co., Tenn., reports as follows:

On the 12th, six miles west of station at Mount Pleasant, nine negroes were instantly killed by lightning while standing under an oak during rain, and another, who was under a tree twenty feet distant, died the next day from the effects of the shock.

Cheyenne, Wyo.: during the prevalence of a thunder-storm on the 14th, a funnel-shaped cloud was observed in the west at 5 p. m.; the cloud apparently touched the ground and at the same time incessant flashes of lightning were seen at the point of the cloud. Heavy rain and hail is reported to have occurred at Bowie, seven miles west of this place, where two hundred feet of embankment and one quarter of a mile of railroad track were washed out.

Waupaca, Waupaca Co., Wis.: about 5 p. m. on the 16th a severe storm passed over this place, causing damage estimated at several thousand dollars. The opera house was totally wrecked and a number of buildings were unroofed. Reports from Oshkosh, Winnebago Co., Wausau, Marathon Co., and DePere, Brown Co., show that the storm at those points was very severe also.

Quakertown, Bucks Co., Pa.: a thunder-storm of considerable violence prevailed from 6.45 to 8.15 p. m. on the 16th. The most violent part of the storm was of about thirty minutes' duration, during which time rain fell in torrents. The path of the storm was about half a mile wide in this locality, and it moved in a southeasterly direction.

"The (Oswego, N. Y.) Palladium" of July 20th states that a very violent wind and hail storm occurred on the 16th at Wolf Island, near Kingston, Ontario, and that much damage was done to out-buildings, fences, etc.

Des Moines, Iowa: during the thunder-storm on the 17th hail as large as pigeons' eggs fell at a point five miles south of station.

Washington City: a severe wind and thunder-storm passed over the city about 5 p. m. on the 17th. Trees were blown down in different portions of the city, and it is reported that houses were unroofed at the Washington Asylum.

Westminster, Carroll Co., Md.: the storm which passed over this county on the afternoon of the 17th was very destructive to crops, and much damage was done by lightning.

Carlisle, Cumberland Co., Pa.: one of the most violent storms ever experienced here occurred at about 3 p. m. on the 17th. It was accompanied by thunder, lightning and hail. The roof and chimneys of the Indian school were blown off; many trees were uprooted.

Buffalo, N. Y.: during a severe squall on the afternoon of the 17th the steamer "Periwinkle" was torn from her moorings, and trees were blown down throughout the city.

Jersey City, N. J.: the storm of the 17th caused considerable damage at this place; a large number of trees and fences were blown down, and a portion of a bridge over the Newark and New York Railroad tracks was demolished.

New York City: on the 17th quite a severe storm occurred between 11.50 a. m. and 1.15 p. m.; considerable damage was done in the upper portion of the city and in that part bordering on the lower bay. The Signal Service observer states that the formation of this storm resembled that of a tornado, the cloud being funnel-shaped, and that its force and form were broken during its passage over the larger buildings of the city. During the night of the 17-18th a storm caused considerable damage to small boats on Long Island Sound, and crops for miles along the beach were seriously injured.

Baltimore, Md., 18th: shortly after 5 p. m. a violent thunder-storm, accompanied by hail and high northwest wind, passed over the city; the wind reaching a velocity of thirty-nine miles per hour at 5.25 p. m.; much damage was done in all sections of the city; many houses were unroofed, trees uprooted, and several buildings were struck by lightning; the hail-stones varied in size from a quarter to half an inch in

diameter, and broke many windows. The storm moved from northwest to southeast.

Wabash, Wabash Co., Ind.: during the night of the 18-19th a severe hail storm passed through the northwestern part of this county, doing an immense amount of damage. The storm came from the west through Miami county and crossed the Lake Erie and Western Railway between Denver and Peru; its path through Wabash county was from two to three miles wide. The hail-stones were unusually large, and fell in large quantities. Apples, melons, grapes, and all small fruits and vegetables were cut to pieces. The damage is estimated at \$50,000.

Wheeling, W. Va.: a violent storm occurred during the night of the 18-19th, blowing down fences and trees; for about one hour the lightning was almost continuous.

Norfolk, Va.: the steamer "H. D. Miller" reports having encountered a severe hail, rain, and wind storm at about 7 p. m. on the 19th during her passage from Baltimore to Norfolk, and when off North Point, in the Chesapeake Bay; hail fell for half an hour, covering the deck of the steamer.

Kitty Hawk, N. C.: on the 19th a thunder-storm from the northeast began at 7.40 a. m. and continued until 11.45 a. m.; an electrical discharge at 9.40 melted the wires, burned insulation and set fire to a curtain and window casing in the telegraph office.

Abilene, Dickinson Co., Kans.: a storm on the 20th caused much damage to buildings, trees, etc., in this vicinity; a number of barns were wrecked.

Parkersburg, Wood Co., W. Va.: during the evening of the 20th a destructive storm passed through Wirt and Wood counties in this state. Dwellings and out-buildings were demolished and many fine orchards and valuable tracts of timber were completely ruined. At Rockport, Wood Co., a large stone mill was demolished.

Pittsburg, Pa.: the heavy rain storm of the evening of the 20th flooded many cellars in this city and in Alleghany City, causing much damage. Reports from the surrounding country show that the storm was very severe.

Brownsville, Saline Co., Mo.: a severe wind and hail storm occurred about eight miles east of this place at about 7.30 p. m. on the 20th. The hail-stones were very large, and many remained on the ground until the morning of the 21st. The width of the storm was about two miles, and within its path great damage was done to crops.

Elkton, Cecil Co., Md.: the storm of the 21st is considered to have been one of the most severe that has occurred here in many years. The very heavy rainfall caused a large amount of damage to roads and bridges in this county.

Corry, Erie Co., Pa.: during the prevalence of a wind storm which occurred near this place on the 22d, a barn was blown down, fences were prostrated, and several orchards damaged; the course of the storm was from southwest to northeast, and its track was from eight to ten rods wide.

Mount Holly, Burlington Co., N. J.: a violent thunder-storm occurred in this part of Burlington county during the night of the 22-23d; about one dozen houses were struck by lightning in and near Mount Holly. The heavy rainfall overflowed cellars and caused washouts along the railroad.

Huron, Dak.: heavy rain, with moderate thunder and lightning, and occasional showers of small hail, prevailed from 4.30 to 6.45 p. m. on the 23d. About one mile east of this place a severe storm destroyed several barns and caused much injury to crops; hail fell over a small area about half a mile long and quarter of a mile wide.

Baltimore, Md.: a thunder-storm prevailed from 4.25 to 5.50 p. m. on the 23d; the heavy rainfall flooded streets and cellars and caused a rapid rise in Jones' Falls, the water rising within a few inches of the bridge. A mud machine and several scows at work at the Falls were driven against the Lombard street bridge, but the damage was slight. The storm moved from northwest to southeast. During the night of the 26-27th another severe thunder-storm, with heavy rain, passed over this

city from northeast to southwest; 1.55 inches of rain fell between 7.40 and 10.45 p. m.; considerable damage was done by flooding of streets and cellars.

Elizabeth, Union Co., N. J.: the very heavy rain which accompanied the storm on the afternoon of the 23d inundated many streets and entered numerous dwellings, compelling the occupants to leave the lower stories. The river at this place rose rapidly.

Philadelphia, Pa.: a thunder-storm of unusual severity began at 3.23 a. m. on the 23d; 2.25 inches of rain fell in one hour; much damage was done in the city to sewers, piers, cellars, etc. The storm came from the southwest and passed northeastward. During the afternoon and evening of the 26th heavy rain occurred at intervals in the north and northwestern portions of the city. At Manayunk, and at Falls of the Schuylkill, there was a very heavy rain storm which caused much damage to property.

Fort Maginnis, Mont.: a severe hail storm, with thunder and lightning, began at 6.15 and ended at 6.30 p. m. on the 24th; hail-stones from two to two and a half inches in diameter fell to a depth of five or six inches and broke all glass in windows with northern exposure; the hail-stones fell with sufficient force to break shingles, crack window-blinds, and kill poultry, lambs, and calves; the storm is reported to have been the most violent ever experienced in this vicinity.

Huron, Dak.: light rain fell during the night of the 24-25th; during the following day the wind blew a gale from the southeast, increasing at night, and attaining at 10.30 p. m. a velocity of sixty-six miles an hour; the storm was attended at intervals during the evening by a light rain, vivid lightning, and heavy thunder. This storm was the severest that has occurred here since March, 20, 1882. Considerable damage was done to the growing crops by the wind, and some damage was done by lightning.

Hay Springs, Sheridan Co., Nebr.: a hail storm occurred about six miles southeast of this place on the 25th; its direction was from southwest to northeast and its path was about one mile wide; crops were injured to some extent.

Parkston, Hutchinson Co., Dak.: the storm during the night of the 26-27th was very severe at this place and in the surrounding country. At a point ten miles north of Parkston several buildings were blown down.

Fargo, Cass Co., Dak.: the storm on the night of the 26-27th was one of the most violent ever known here. Much damage was done to buildings, fences, etc. It is reported that the wind reached a velocity of eighty miles per hour.

Yankton, Dak.: during the night of the 26-27th a storm of great severity occurred at this place, blowing down trees, and causing slight damage to some buildings. The wind reached a velocity of fifty-four miles per hour.

Fort Worth, Tarrant Co., Tex., 27th: reports from Anson, Jones Co., state that a violent storm on the 26th caused damage to buildings, etc., in that vicinity to the extent of \$40,000. At Haskell, Haskell Co., nearly all the building in the town were demolished.

Pensacola, Fla.: during the storm on the 27th no damage was done in this city, but to the eastward the storm was more severe and resulted in considerable damage. At De Funiak, Walton Co., several houses were unroofed, and trees blown across the railway track; one fishing smack was wrecked.

Oskaloosa, Mahaska Co., Iowa: the thunder-storm on the 28th caused much damage to life and property in the surrounding country.

Franklin Falls, Merrimac Co., N. H.: a severe thunder-storm occurred during the night of the 28-29th, causing a large amount of damage to crops and washing out highways.

Omaha, Nebr.: reports from David City, Butler Co., state that a number of buildings were demolished by a storm which occurred at 6 p. m. on the 29th. Among the buildings destroyed were the depots of the Union Pacific and Burlington and Missouri railroads.

Mason City, Cerro Gordo Co., Iowa: at about 5 p. m. on the

29th, a severe storm occurred at this place; several buildings were unroofed and some were blown down.

Boston, Mass.: unusually severe thunder-storms occurred in eastern Massachusetts and in portions of New Hampshire during the month of July, 1887.

Report of tornadoes for the month of July, 1887, by 2d Lieutenant John P. Finley, Signal Corps, Assistant.

Place.	Date.	Time.	Direction.	Form of cloud.	Number of persons killed.	Number of persons wounded.	Width of path in feet.	Number and kind of animals killed.	Number and kind of buildings destroyed.	Total valuation of property destroyed.	Authority.
Cleburne, Tex. <i>a</i>	5	3.30 p. m.	nw.	.....	None	2	2,640	.....	1 house destroyed and several damaged.	.....	Dr. T. C. Osborne, Cleburne, Tex.
Weston, Wis.	6	5 p. m.	ne.	Funnel	.....	.....	800 to 4,000	Some cattle.	Swept acres of timber away.	.....	R. B. Wilkinson, Weston, Wis.
Near New Riegel, Ohio <i>b</i>	8	1.30 p. m.	.....	Bunch shape.	None	None	.....	.....	Orchards, shade trees, and crops prostrated.	.....	C. H. Klein, New Riegel, Ohio.
Cambridge, Mich. <i>c</i>	9	2.30 p. m.	nw.	.....	None	None	.....	.....	Totally destroyed 3 buildings, overturned barns, and prostrated trees.	.....	C. H. Dowsy, Cambridge, Mich.
Goddard, Dak. <i>d</i>	10	4 p. m.	ne.	Funnel	.....	.....	.....	.....	Great destruction to crops.	.....	J. F. Hahnen, Goddard, Dak.
Fairbank, Dak. <i>e</i>	10	4 p. m.	se.	Funnel	.....	.....	.....	.....	Considerable damage to buildings and crops.	.....	C. D. Thompson, Fairbank, Dak.
Lewiston, Dak. <i>f</i>	10	3.30 p. m.	se.	Funnel	.....	.....	.....	.....	Very destructive to crops.	.....	P. W. Pearson, Lewiston, Dak.
Shiloh, Dak.	10	6 p. m.	se.	.....	.....	.....	.....	.....	Small buildings torn to pieces.	.....	T. Wright, Shiloh, Dak.
Stockton, Ill.	13	Evening	ne.	Funnel	.....	.....	.....	.....	1 large and several smaller buildings destroyed.	.....	Saint Louis "Globe Democrat."
Valparaiso, Nebr. <i>g</i>	14	Afternoon	ne.	Funnel	.....	.....	200 to 320	.....	Houses and out-buildings torn to pieces, crops ruined.	.....	E. J. Brethourder, Holland, Nebr.
Easton, Pa. <i>h</i>	16	6 to 7 p. m.	.....	.....	.....	.....	.....	.....	Very destructive	\$50,000	"Commercial Gazette," Pittsburg, Pa.
Moorestown, N. J. <i>i</i>	16	7.45 p. m.	easterly	Funnel	.....	.....	Narrow	.....	Destructive to crops and timber.	.....	T. J. Beans, Moorestown, N. J.
Loyal, Wis. <i>j</i>	16	2 p. m.	ne.	.....	.....	.....	3,200	.....	Very destructive to timber through which it passed.	.....	W. Welsh, Loyal, Wis.
Waupaca, Wis. <i>k</i>	16	5 p. m.	ne.	.....	None	None	.....	Several head of cattle.	Destroyed opera-house and did considerable damage to dwelling houses.	.....	G. M. Chamberlin, Waupaca, Milwaukee "Sentinel," Wis.
New York City <i>l</i>	17	Noon	easterly	.....	.....	.....	.....	.....	Houses unroofed, trees blown down, and considerable damage done to shipping.	.....	New York "World" and "Tribune," July 18, 1887.
New York City	17	11 p. m.	e.	Cone shape.	.....	.....	.....	.....	Struck a steamboat, tore off her smoke-stack, and sent her round like a top.	.....	New York "Tribune," July 18, 1887.
Carlisle, Pa.	17	3 p. m.	.....	.....	.....	.....	.....	.....	Trees uprooted, buildings unroofed, and thousands of window panes shattered by hail.	.....	Baltimore "Sun," July 18, 1887.
Westminster, Md. <i>m</i>	17	4 p. m.	se.	Funnel	None	None	Narrow	.....	Very destructive	.....	Baltimore "American" and "Sun,"
Baltimore, Md. <i>n</i>	17	3 to 4 p. m.	.....	.....	1	Several	.....	.....	.....	.....	Dr. J. F. Llewellyn, Mexico, Mo.; J. T. De Sellum, Gaithersburg, Md.; Baltimore "Sun."
Rushville, N. Y.	17	6 p. m.	e.	.....	None	None	2,640	.....	Several barns and out-buildings destroyed; hardly a tree or fence in its path escaped.	.....	Dr. M. A. Veeder, Lyons, N. Y.
Near Emporia Junction, Kans. <i>o</i>	19	4 p. m.	ne.	Funnel	.....	.....	.....	.....	.....	.....	Signal Service observer, Topeka, Kans.
Topeka, Kans. <i>p</i>	21	8.35 to 8.45 p. m.	e.	Funnel	None	None	.....	.....	.....	.....	Do.
One mile south of Liberty Centre, Ohio.	21	Evening	ne.	.....	.....	.....	3,200	.....	Damage confined to timber and crops in path.	.....	Dr. T. C. Hunter, Napoleon, Ohio.
Hearne, Tex. <i>q</i>	22	4.30 p. m.	.....	.....	.....	.....	.....	.....	Several residences blown down, buildings unroofed, trees and fences prostrated.	5,000	R. N. Cone, Cone, Tex.
Wytheville, Va. <i>r</i>	23	8.45 p. m.	.....	.....	.....	.....	.....	.....	.....	.....	Howard Shriver, Wytheville, Va.
Watkinsville, Ga. <i>s</i>	24	6 p. m.	ne.	Funnel	None	None	.....	.....	.....	.....	Atlanta, Ga., "Constitution."
Moland Township, Minn. <i>t</i>	25	11 p. m.	easterly	Funnel	None	Several	A few rods	.....	Several farm houses and granaries destroyed, trees prostrated, &c.	200,000	C. S. Taylor, Glyndon, Signal Service observer and "Evening News," Moorhead, Minn.; G. A. Grover, Horace, Dak.
David City, Nebr. <i>u</i>	29	6 p. m.	ne.	Funnel	1	.....	2,640 to 5,280	Several horses and head of cattle.	Destroyed a large number of buildings.	.....	F. E. Wileet, David City, E. Whitcomb, Friend, Nebr., and "Butler County Press."
Waterloo, S. C. <i>v</i>	29	9.30 a. m.	.....	Funnel	1	.....	150	.....	Destructive to everything in its path, which was well defined.	.....	J. B. Anderson, Waterloo, S. C.

a Two clouds, one from the east and one from the west, met and fell towards the earth like a mass of solid matter, and in an instant the city was embraced by a twisting wind. *b* A bunch-shaped cloud moved below the main cloud with a continued roar, the cloud having a rotary motion. *c* The wind appeared to be more severe over head, but would strike the earth every now and then, causing great destruction. *d* Cloud very dark, with a greenish tinge, but was rather too high to do much damage; it was accompanied by an intense, rumbling noise. *e* There seemed to be three strata of clouds, all going in different directions, the funnel-shaped cloud being between the others and trying to force its way through the lower one. *f* There was one funnel-shaped cloud with the wide end down; it was some distance ahead of the main storm and was accompanied by a roaring noise. *g* The funnel cloud was white as snow and seemed to move in bounds; it would touch the earth for some sixty rods and then draw up to touch again further on. *h* The cloud came down the Delaware Valley, reaching nearly to the ground; it was struck by a cross wind and then began its work of destruction. *i* A funnel-shaped cloud formed at the western extremity of an arch of clouds. *j* The cloud was attended by a heavy roar. *k* Two clouds united, which gave a rotary motion to the wind. *l* A big, black cloud, with white, torn edge, turning over and over like a windmill, came suddenly with the speed of a race horse. *m* The cloud came suddenly in the shape of a funnel, carrying fences and all movable objects with it. *n* In the western section of the city the cloud was lower, touching the tops of trees and houses. *o* From a distance it had the appearance of a tall column, reaching from the ground to the clouds. *p* The cloud did not reach the earth; it had the appearance of an old fashioned, high hat inverted and extended one-eighth of the distance from the main cloud to the earth. *q* Two dense and angry looking clouds were observed approaching from opposite directions, and on their uniting a terrific wind occurred. *r* Cloud did not touch the earth. *s* A cloud of inky blackness approached at a terrific rate, accompanied by a frightful roar. The wind at the ground was quite violent, being sufficient to cause considerable damage to trees and out-buildings, but the tornado cloud did not touch the ground. *t* Two clouds, one from the southwest and one from the northwest, met, when a great commotion immediately ensued, resulting in the formation of three "twisters." As the storm progressed the tornado cloud resembled a tall steeple, moving at a rapid rate. *u* A large, black, twisting, and boiling mass of clouds, somewhat funnel-shaped, with a whitish mist or vapor preceding it, accompanied by a roar.

ing the afternoon of the 29th. The sloop "Gris" was driven ashore on Corinthian Point in Boston Harbor during a squall on the above date.

Pittsburg, Pa.: light rain prevailed from 1.20 to 3 p. m. on the 30th; at 4.40 p. m. a severe thunder-storm set in from the southwest and continued till 6.15 p. m.; heavy rain, with hail, occurred from 5.10 to 5.30 p. m., the rainfall amounting to 1 inch, most of which fell in twenty minutes; the wind reached a velocity of thirty-six miles an hour from the northwest; the damage done to various kinds of property is estimated at \$70,000.

Hartford, Conn.: a severe hail storm on the afternoon of the 31st caused great damage to corn, tobacco, and other crops in South Glastonbury and neighboring localities. Large trees were blown down and the roads were badly washed.

New London, Conn.: "The Day" of August 1st states the storm of July 31st was among the severest that has been

experienced at New London in many years, and caused damage throughout the city and in other portions of the state; numerous objects were struck by lightning. At Hartford the storm was accompanied by hail which caused much damage to crops in that vicinity.

New Haven, Conn.: during the thunder-storm which began at 2.50 and ended at 4.30 p. m. of the 31st, several buildings and trees were struck by lightning.

WATER-SPOUTS.

Capt. J. Meikle, of the bark "Ashantee," reports having observed a large water-spout July 9th, at 8 a. m., in N. 38° 40', W. 68° 31', during the prevalence of a heavy thunder-storm, with hard sw. squalls and heavy rain from 2 a. m. till noon.

Capt. G. Stenger, of the s. s. "Leerdam," reports: "June 21st, 4.15 p. m., in N. 41° 02', W. 60° 23', observed large water-spouts which moved from sw. to ne."

COTTON REGION REPORTS.

In the following table are given the means of the maximum and minimum temperatures, and the average rainfall for the cotton-belt districts during the month. For the purpose of comparison the means for the five preceding years are also given.

The rainfall for the districts of Galveston and Little Rock differs but slightly from the average; that for the district of Memphis is 1.06 below the average, while in the other districts the rainfall is excessive. The excess for the districts of Augusta, Atlanta, Montgomery, and Savannah is very large, that for Augusta amounting to 7.54 inches. In the last-named district reports from twelve stations give an average of 11.49 inches, which is nearly three times as great as the normal precipitation as determined from the cotton-region observations of the last five years; the average for the Atlanta district (reports from thirteen stations) is more than double the normal, while the excess for the Montgomery district is nearly as great.

The means of the maximum and minimum temperatures in all districts are generally normal or slightly above.

Temperature and rainfall data for the cotton districts, July.

Districts.	Rainfall.			Temperature.								Extremes for July, 1887.	
	Average for July of five preceding years.	Average for July, 1887.	Departures.	Maximum.				Minimum.					
				Mean for July of five preceding years.	Mean for July, 1887.	Departures.		Mean for July of five preceding years.	Mean for July, 1887.	Departures.			
New Orleans.....	Inch.	Inch.	Inch.	°	°	°		°	°	°		°	°
Savannah.....	4.26	5.93	+ 0.77	92.9	92.4	- 0.5		73.1	71.7	- 1.4		103	61
Charleston.....	5.74	8.65	+ 2.91	92.3	93.0	+ 0.7		72.0	72.7	+ 0.7		105	50
Atlanta.....	6.36	6.99	+ 0.63	91.6	92.3	+ 0.6		70.5	72.4	+ 1.9		105	61
Wilmington.....	4.01	9.77	+ 5.76	90.2	90.3	+ 0.1		68.3	71.1	+ 2.8		106	55
Memphis.....	5.37	6.35	+ 0.98	90.7	92.6	+ 1.9		68.5	71.7	+ 3.2		111	46
Galveston.....	3.86	2.84	- 1.06	90.5	92.5	+ 2.0		68.5	70.1	+ 1.6		106	49
Vicksburg.....	2.09	2.07	- 0.02	95.5	95.5	0		72.7	74.0	+ 1.3		105	61
Montgomery.....	5.10	5.47	+ 0.37	92.6	92.7	+ 0.1		71.4	72.5	+ 1.1		103	55
Augusta.....	4.32	8.47	+ 4.15	91.7	90.3	- 1.5		69.0	71.9	+ 2.9		101	63
Little Rock.....	3.95	11.49	+ 7.54	92.2	92.5	+ 0.3		70.1	71.8	+ 1.7		110	63
Mobile.....	2.59	2.38	- 0.21	92.8	93.2	+ 0.4		68.1	68.5	+ 0.4		105	50
	3.78	5.39	+ 1.61	93.5	93.3	- 0.2		70.4	70.0	- 0.4		105	58

INLAND NAVIGATION.

FLOODS.

Raleigh, N. C.: during a heavy thunder-storm on the 7th 4.90 inches of rain fell from 10 to 11.30 p. m. Reports from the surrounding neighborhood show that this phenomenal rainfall was not general; at the signal office, only two miles distant, the rainfall measured but 1.79 inches. Portions of the dam of the water-works were washed out, and the crops lying in the storm's area were somewhat damaged.

Nogales, Pima Co., Ariz.: on the afternoon of the 7th a remarkably heavy rain storm occurred. Streets were flooded and dams and bridges washed away. Washouts occurred on the Sonora Railroad, causing delay of trains. On the afternoon of the 13th another heavy rain storm occurred. It is reported that on the mountains to the southwest of Sonora there was a "cloud burst," which in a short time flooded a portion of Sonora, washing away a number of houses.

Fort Apache, Ariz.: during the prevalence of a thunder-storm from 5.20 to 8.10 p. m. on the 8th, a "cloud burst" occurred on the east fork of the White River, in the mountains east of station. A volume of water three feet deep came down the canyon, carrying on its crest large trees, etc.; the water subsided in about two hours.

The "Salt Lake Herald" of the 13th states:

FILLMORE, UTAH, July 11.—Last evening a flood again devastated Fillmore and the surrounding country. The greatest damage was done in the mountains east of this place. Three saw-mills, with logs and lumber aggregating thousands of feet, were swept entirely away. Half of a large herd of sheep

was lost, the herders narrowly escaping with their lives. The damage done will materially affect the whole community.

The Saint Louis "Globe-Democrat" of the 15th contained the following:

DENVER, COLO., July 14.—A terrific cloud-burst occurred in Tucker Canyon, near Golden, twenty miles from Denver, this afternoon. The canyon was full of campers, ore-haulers, etc. A slight rain storm succeeded peals of thunder, and suddenly a wave nearly twenty feet high swept down the narrow canyon, which for weeks had been completely dry. Everything was swept before it. The sides of the gulch, which is only sixty feet wide, were swept away, as were also the trail and carriage-way for miles up the canyon. Those who were caught out, so far as is known, left their teams and fled to the mountains. All the latter part of the afternoon people have been walking into Golden from the hills. They report the loss of their teams and vehicles, and all give exciting accounts of their narrow escapes from death. They fear that many lives have been lost, as many people who went up into the mountains have not yet been heard from.

The huge wave in the canyon was the result of a cloud-burst, which may have occurred far up in the canyon. The loss to ranchmen in the valley has been heavy.

The Cheyenne, Wyo., "Daily Leader" of the 16th contained the following:

ALBUQUERQUE, N. MEX., July 16.—A special to the "Democrat" from Benson, Ariz., says the heavy rains of the past few days have caused serious washouts on the New Mexico and Arizona and Sonora railroads, and it will be three or four weeks before trains can go through to Nogales. Water has run down from the mountains in large volumes, drowning considerable stock in the valleys.

San Francisco, Cal.: the first mails from the East since the 16th arrived during the night of the 18th, the delay having

been caused by washouts on both the Central and Southern Pacific routes.

Baltimore, Md.: nearly three inches of rain fell during the storm of the 21st, and the greater part of this amount fell between 10.30 a. m. and noon. Damage to the extent of several thousand dollars was done by the flooding of sewers, etc.

Great Barrington, Berkshire Co., Mass.: the heavy rainfall on the morning of the 22d caused Green River to overflow. At Alford, in this county, a bridge was washed away; considerable damage was done at other points.

Chatham, Columbia Co., N. Y.: the rainfall on the 23d in some portions of this county was remarkably heavy. A large amount of damage was done to bridges and roadways, and in many places fields were inundated and the crops ruined.

Philadelphia, Pa.: on the 23d and 24th the heavy rainfall (about four inches) caused much damage in this city to streets and sewers.

Menands, Albany Co., N. Y.: to the east and south of Albany, destructive freshets resulted from the heavy rains which occurred during the 23d-24th, causing much damage to property. In Columbia county many dwellings were washed away.

Orange, Franklin Co., Mass.: the freshet of the 25th was the most destructive that has occurred here for many years. A number of factories had their first floors flooded.

Dover, Strafford Co., N. H., 25th: all rivers in this part of the state are unusually high. At New Market, Rockingham Co., a part of a dam of the New Market Cotton Mill was carried away, together with some derricks and engines.

Wellsborough, Tioga Co., Pa.: on the 25th and 26th 4.15 inches of rain fell at this place; this is the heaviest rainfall that has occurred during the last eight years. Cellars were filled with water, bridges carried away, and in many places railroad tracks were washed out, causing delay of trains.

Binghamton, Broome Co., N. Y.: the heavy rains on the night of the 25-26th caused a freshet at Deposit, in this county. All of the smaller bridges in that vicinity were washed away. The water about the railroad buildings was two feet deep.

Coatesville, Chester Co., Pa.: on the 26th heavy rains caused a washout on the Pennsylvania Railroad, about half a mile west of this place. Reports from Susquehanna county state that numerous bridges in that county were washed away. At Red Rock, Luzerne Co., about two thousand feet of railroad track were washed out.

Reading, Berks Co., Pa.: the heavy rainfall of the 26th flooded a large number of basements and cellars in this city. Numerous washouts occurred on the railroads in the surrounding country, causing delay of trains.

Greenfield, Franklin Co., Mass.: the heavy rainfall of the 26th caused a large number of washouts and land-slides between Miller's Falls and Erving, in this county.

Philadelphia, Pa.: the rainfall on the night of the 26-27th caused a large amount of damage at Falls of the Schuylkill, where, on many streets, the lower floors of houses were submerged. The damage is estimated at \$100,000. At Manayunk the streets were washed out and houses and mills were flooded.

Contoocook, Merrimack Co., N. H.: the Warren and Contoocook rivers began to overflow on the 27th. The high water at Contoocook caused partial suspension of business.

Augusta, Ga.: the heavy rains at the close of the month caused the Savannah River to rise to a height which has not been equaled since 1865; the river reached its greatest height,

34.5 feet, about 9 a. m. of the 31st and remained stationary until 3 p. m.; quantities of drift-wood were carried past the city by the rapid current, and fears were entertained for the safety of the bridges which cross the river. A considerable portion of the city was inundated, and in some places the water was ten feet deep. Travel on railroads was interrupted and the operations of mills were suspended. The rainfall on the 29th amounted to 4.50 inches, which is the largest daily rainfall on the records of the Signal Office at this place. In but three instances since 1840 has the river reached a greater height than during the freshet of July, 1887, viz.: in 1840, 37.3 feet; 1852, 36.8 feet; and 1865, 36.4 feet. During the freshet of 1864 the river reached a height of 33.8 feet.

Forsyth, Monroe Co., Ga.: from the 27th to 31st about 9 inches of rain fell at this place; this remarkably heavy rainfall was very destructive to crops in this part of the state.

Wetumpka, Elmore Co., Ala.: owing to recent heavy rains the Coosa and Alabama rivers were very high on this date. Hundreds of acres of corn land have been submerged.

Milledgeville, Baldwin Co., Ga.: the precipitation for the month, 16.09 inches, is unprecedented at this station for the month of July; the first rainy season occurred from the 4th to the 12th, when 5.75 inches of rain fell; and the second from the 27th to the 31st, when 9.98 inches of rain fell. This latter rainfall caused a freshet similar to that in 1840. Great damage was done in this county to crops, bridges, fences, etc.

STAGE OF WATER IN RIVERS AND HARBORS.

In the following table are shown the danger-points at the various river stations and the highest and lowest depths for July, 1887, with the dates of occurrence, and the monthly ranges:

Heights of rivers above low-water mark, July, 1887.

[Expressed in feet and tenths.]

Stations.	Danger-point on gauge.	Highest water.		Lowest water.		Monthly range.
		Date.	Height.	Date.	Height.	
<i>Red River:</i>						
Shreveport, La.	29.9	1	11.9	31	6.0	5.9
<i>Arkansas River:</i>						
Fort Smith, Ark.	22.0	10	7.0	26, 31	2.3	4.7
Little Rock, Ark.	23.0	14	6.3	31	2.4	3.9
<i>Missouri River:</i>						
Omaha, Nebr.	18.0	2, 3, 4	14.9	29, 31	10.3	4.6
Leavenworth, Kans.	20.0	2, 3	16.5	31	11.7	4.8
<i>Mississippi River:</i>						
Saint Paul, Minn.	14.5	20, 21, 24	2.9	31	2.3	0.6
La Crosse, Wis.	24.0	1, 2, 4	4.4	31	3.0	1.4
Dubuque, Iowa	16.0	1, 3, 4	4.5	29, 30, 31	2.7	1.8
Davenport, Iowa	15.0	4, 5	3.1	29, 30, 31	1.6	1.5
Keokuk, Iowa	14.0	5	2.9	31	1.4	1.5
Saint Louis, Mo.	32.0	5, 6	16.9	31	10.1	6.8
Cairo, Ill.	40.0	5, 6, 7	16.2	31	8.8	7.4
Memphis, Tenn.	34.0	7	13.4	29, 30, 31	8.2	5.2
Vicksburg, Miss.	41.0	1	18.9	31	7.5	11.4
New Orleans, La.	13.0	1	7.2	29	3.2	4.0
<i>Ohio River:</i>						
Pittsburg, Pa.	22.0	21	6.9	30	1.5	5.4
Cincinnati, Ohio	50.0	1	8.1	22	4.3	3.8
Louisville, Ky.	25.0	1, 2	4.9	14, 24, 31	3.5	1.4
<i>Cumberland River:</i>						
Nashville, Tenn.	40.0	9	1.9	21, 28-31	0.9	1.0
<i>Tennessee River:</i>						
Chattanooga, Tenn.	33.0	10	5.6	20	1.9	3.7
<i>Monongahela River:</i>						
Pittsburg, Pa.	29.0	21	6.9	30	1.5	5.4
<i>Savannah River:</i>						
Augusta, Ga.	32.0	31	34.5	4	5.1	29.4
<i>Sacramento River:</i>						
Red Bluff, Cal.		1, 2, 3, 4	1.0	28, 29, 30, 31	0.6	0.4
Sacramento, Cal.		1, 2, 3	11.0	31	8.1	2.9
<i>Willamette River:</i>						
Portland, Oregon.		1	23.5	31	12.5	11.0

ATMOSPHERIC ELECTRICITY.

AUROSAS.

But few auroras were observed during July, and none of the displays reported were noted for brilliancy or extent of observation. The most extended displays of the month occurred on the nights of the 18-19th and 19th-20th; these were observed

principally from the Lake region eastward to the New England coast. The Signal Service observer on the summit of Mount Washington, N. H., reports: An auroral light was observed at 9.30 p. m. on the 18th, extending 20° east and west of the magnetic meridian; it very rapidly assumed the formation of an

arch, with dark segments beneath; the arch was well defined and extended to an altitude of about 15° , and azimuth 100° , while the auroral light reached an altitude of 140° . After 10.05 p. m. no streamers appeared, although the arch remained visible until daybreak on the 19th, with but little variation in brilliancy and extent. A similar display occurred the following night.

Auroras were noted on other dates, as follows:

5th, Fort Sully, Dak. 6th, Cresco, Iowa; Lansing, Mackinaw City, and Marquette, Mich.; Fort Totten, Dak.; Saint Paul, Minn. 7th, Lyons, N. Y. 12th, Egg Harbor City, N. J. 14th, Fall River, Mass. 15th, Gardiner and Eastport, Me.; Poplar River, Mont. 17th, Berlin Mills and Nashua, N. H. 18th, Windsor, Ill.; Cresco, Iowa, Eastport, and Bar Harbor, Me.; Traverse City, Mackinaw City, Marquette, Escanaba, and Alpena, Mich.; Poplar River, Mont.; Moorestown, N. J.; Northfield, Vt. 19th, Windsor, Ill.; Vevay Ind; Eastport and Bar Harbor, Me.; Lansing, Traverse City, Swartz Creek, Mackinaw City, Escanaba, and Alpena, Mich.; Poplar River, Mont.; Egg Harbor City, N. J.; Charlotte and Northfield, Vt.; Green Bay, Wis. 20th, Pekin, Ill.; Bar Harbor, Me.; Mackinaw City, Mich.; Clayton, N. J.

THUNDER-STORMS.

Thunder-storms are reported to have occurred in the various states and territories on the several dates as follows:

1st.—Ariz., Ark., Cal., Colo., Dak., Fla., Ill., Ind., Ind. T., Iowa, Kans., La., Me., Mass., Mich., Mo., Mont., Nebr., N. Y., Pa., Tenn., Tex., Wis., Wyo.

2d.—Ark., Colo., Dak., Fla., Ill., Ind., Ind. T., Iowa, Kans., La., Me., Mass., Mich., Mont., Nebr., N. H., N. J., N. Y., Ohio, Pa., S. C., Tenn., Tex., Vt., W. Va., Wis.

3d.—Ala., Ariz., Colo., Fla., Ga., Ill., Ind., Ind. T., Iowa, Kans., Ky., La., Mich., Mo., Nebr., N. H., N. Mex., N. Y., Ohio, Pa., S. C., Tenn., Tex., Vt., W. Va., Wis., Wyo.

4th.—Ala., Ariz., Ark., Colo., Fla., Ga., Ill., Ind., Ind. T., Kans., Ky., La., Mich., Nev., N. Mex., N. Y., Ohio, Pa., S. C., Tenn., Tex., W. Va.

5th.—Ala., Ariz., Ark., Cal., Col., Fla., Ga., Ill., Ind., Ind. T., Kans., Ky., La., Md., Mass., Mich., Miss., Nebr., Nev., N. J., N. Y., Ohio, Oregon, Pa., S. C., Tenn., Tex., Va.

6th.—Ala., Ariz., Ark., Conn., Dak., Fla., Ga., Ill., Ind., Ind. T., Kans., Ky., La., Md., Mass., Miss., Mont., N. J., N. Y., N. C., Ohio, Oregon, Pa., R. I., S. C., Tenn., Tex., Vt., Va., Wash., W. Va., Wyo.

7th.—Ariz., Colo., Dak., Fla., Ga., Ill., Ind., Ky., La., Mass., Miss., Mo., Mont., Nebr., N. H., N. Y., N. C., Pa., R. I., S. C., Tenn., Tex., Va., Wyo.

8th.—Ala., Ariz., Cal., Colo., Dak., Fla., Ill., Ind., Iowa, Kans., Ky., La., Mich., Minn., Miss., Nebr., N. J., N. C., Ohio, S. C., Tenn., Tex., Va., Wis.

9th.—Ala., Ariz., Ark., Cal., Colo., Conn., Dak., D. C., Fla., Ga., Ill., Ind., Ind. T., Iowa, Kans., Ky., Md., Mass., Mich., Miss., Nebr., Nev., N. H., N. J., N. C., Ohio, Pa., R. I., Tenn., Tex., Utah, Vt., Va., W. Va., Wis., Wyo.

10th.—Ala., Ariz., Ark., Colo., Conn., Dak., Fla., Ga., Idaho, Kans., La., Me., Mass., Miss., Mont., Nebr., Nev., N. J., N. C., Pa., R. I., S. C., Tenn., Tex., Utah, Wyo.

11th.—Ala., Ariz., Ark., Colo., Dak., Fla., Ga., Ill., Iowa, Kans., La., Mass., Minn., Mont., Nebr., N. Mex., N. C., S. C., Tenn., Tex., Wis., Wyo.

12th.—Ala., Ariz., Ark., Colo., Dak., Fla., Ga., Ill., Ind. T., Iowa, Kans., La., Mich., Miss., Mo., Mont., Nebr., S. C., Tenn., Tex., Utah, Wis.

13th.—Ala., Ariz., Ark., Colo., Dak., Fla., Ga., Ind. T., Iowa, Kans., La., Mich., Miss., Mont., Nebr., Ohio, Pa., S. C., Tenn., Tex., Wis.

14th.—Ala., Ariz., Ark., Col., Dak., D. C., Fla., Ill., Ind. T., Kans., Ky., La., Mass., Minn., Miss., Nebr., N. J., N. C., Ohio, Tenn., Tex., Utah, Va., Wis., Wyo.

15th.—Ala., Ariz., Ark., Col., Dak., Fla., Ind. T., Kans., Minn., Mont., Nebr., N. Y., N. C., Ohio, Pa., Tenn., Tex., Utah, Va., Wyo.

16th.—Ala., Ark., Colo., Conn., Dak., Fla., Ga., Ill., Iowa, Kans., Md., Mass., Mich., Minn., Mont., Nebr., N. H., N. J., N. Y., Ohio, Pa., S. C., Tex., Utah, Va., Wis.

17th.—Ala., Ariz., Colo., Conn., Dak., D. C., Fla., Ill., Ind., Ind. T., Iowa, Kans., Ky., La., Md., Mass., Mich., Mont., Nev., N. J., N. Y., N. C., Ohio, Pa., R. I., S. C., Tenn., Tex., Va., Wis., Wyo.

18th.—Ala., Ark., Colo., Conn., Dak., D. C., Fla., Ga., Ill., Ind., Ind. T., Iowa, Kans., Ky., La., Md., Mass., Minn., Nev., N. J., N. Mex., N. Y., N. C., Ohio, Oregon, Pa., R. I., S. C., Tenn., Tex., Utah, Va., W. Va., Wis., Wyo.

19th.—Ala., Ark., Cal., Colo., Dak., D. C., Fla., Ga., Ill., Ind., Kans., Md., Mich., Minn., Miss., Nebr., N. J., N. C., Ohio, Pa., S. C., Tenn., Va., W. Va., Wyo.

20th.—Ala., Ark., Colo., Dak., Fla., Ga., Ill., Ind. T., Iowa, Kans., La., Miss., Mo., Mont., Nebr., N. C., Ohio, Pa., S. C., Tenn., Tex., Va., Wash., W. Va., Wyo.

21st.—Ala., Ark., Colo., Conn., Dak., D. C., Fla., Ga., Ill., Ind., Iowa, Kans., Ky., La., Md., Mich., Minn., Miss., Mo., Mont., Nebr., N. J., N. Y., N. C., Ohio, Pa., S. C., Tenn., Tex., Va., Wash., Wis., Wyo.

22d.—Ala., Ark., Colo., Conn., Fla., Ga., Ill., Ind., Ky., La., Md., Mich., Miss., N. J., N. Y., N. C., Ohio, Pa., S. C., Tenn., Texas, Vt., Va., Wash., Wyo.

23d.—Ala., Ariz., Ark., Conn., Dak., D. C., Fla., Ga., Idaho, La., Me., Md., Mass., Mont., Nebr., N. H., N. J., N. Y., N. C., Pa., S. C., Tenn., Texas, Va., Wash.

24th.—Ala., Ariz., Ark., Colo., Conn., Dak., D. C., Fla., Ga., Ind., Ky., La., Me., Md., Mass., Minn., Miss., Mont., N. J., N. Y., N. C., Ohio, Pa., S. C., Tenn., Texas, Va., Wash., W. Va.

25th.—Ala., Ariz., Ark., Colo., Dak., D. C., Fla., Ga., La., Me., Md., Minn., Mont., Nebr., N. J., N. Y., N. C., Ohio, Pa., S. C., Tenn., Texas, Va., Wash., W. Va.

26th.—Ala., Ark., Colo., Conn., Dak., D. C., Fla., Idaho, Ind., Kans., Ky., La., Md., Mass., Minn., Mont., Nebr., N. J., N. Y., N. C., Pa., S. C., Tenn., Va., W. Va., Wis.

27th.—Ark., Cal., Colo., Conn., Dak., D. C., Fla., Ga., Ill., Ind., Iowa, Kans., Md., Mass., Mich., Minn., Nebr., N. H., N. J., N. Y., N. C., Ohio, Oregon, Pa., Tenn., Texas, Va., Wis., Wyo.

28th.—Ariz., Ark., Cal., Dak., Fla., Ga., Idaho, Ill., Ind., Iowa, Me., Mass., Minn., Mont., Nebr., N. H., N. Y., N. C., Ohio, Oregon, S. C., Tenn., Texas, Vt., Va., Wis., Wyo.

29th.—Ala., Ariz., Ark., Colo., Conn., Dak., Fla., Ga., Iowa, La., Me., Mass., Mich., Minn., Nebr., N. H., N. J., N. Y., N. C., Pa., S. C., Tenn., Texas, Vt., Va., W. Va., Wis.

30th.—Ala., Ariz., Ark., Colo., Fla., Ga., Ill., Ind. T., Iowa, Kans., Me., Mich., N. H., N. J., N. Y., Ohio, Pa., S. C., Texas, Vt., Va., W. Va., Wis.

31st.—Ark., Colo., Conn., Dak., Fla., Ga., Ill., Ind., Kans., Ky., Me., Md., Mass., Minn., Mont., Nebr., N. J., N. Y., N. C., Ohio, Oregon, Pa., R. I., S. C., Tenn., Texas, Vt., Va., Wyo.

OPTICAL PHENOMENA.

HALOS.

1st-6th.—Lunar halos were quite numerous in the states to the south of the Ohio and east of the Mississippi Rivers during this period, while a few solar halos were observed in the districts to the northward. These halos were noted during

the passage of the area of low pressure, described as number i., from the middle Rocky Mountain slope to the Saint Lawrence Valley.

7-24th.—During this interval lunar halos were reported from but four stations, viz., Vevay, Ind., 7th; Erie, Pa., 8th;

Spartanburg, S. C., 11th; and Titusville, Fla., 24th. Neither were solar halos of frequent occurrence, only a few stations reporting them on scattering dates.

25th-31st.—In the states east of the Mississippi River lunar halos were reported from numerous stations, and solar halos were quite frequent in the Southern States. It was during this period that the tropical storm, described under areas of low pressure as number viii., passed from the region of the West Indies to the east Gulf states.

The phases of the moon, Washington mean time, during July, as given in "The American Ephemeris and Nauti-

cal Almanac" for 1887, are as follows: Full moon, 4th, 15 h. 25.9 m.; last quarter, 12th, 13 h. 48.8 m.; new moon, 20th, 3 h. 41.8 m.; first quarter, 26th, 21 h. 22.1 m.; apogee, 11th, 13.4 h.; perigee, 23d, 12.9 h.

MIRAGE.

Moorhead, Minn.: a mirage was observed at daybreak on the 22d; the outlines of the shores of two lakes lying about twenty miles east of this place were plainly seen.

Mirage was also reported to have been observed during the month, as follows: Vashon, Wash., 9th, 10th; Reidsville, N. C., 18th; Oswego, N. Y., 24th.

MISCELLANEOUS PHENOMENA.

FOREST AND PRAIRIE FIRES.

Wellsborough, Tioga Co., Pa.: on the 11th and 12th about 4,000 acres of forest and partially cleared land in the vicinity of Gaines, in this county, were burned over. About five hundred cords of bark, several million feet of timber and lumber, a railway trestle, and several cars were destroyed.

Fort Spokane, Wash.: on the 13th and 14th fires were burning east and south of this station.

Helena, Mont.: fires were burning in the woods thirty-five miles north of this place on the 21st.

Forest and prairie fires are also reported to have occurred as follows:

Linkville, Oregon, 1st to 14th.

Fort Reno, Ind. T., 7th.

Fort Klamath, Oregon, 15th.

INSECTS.

Perham, Otter Tail Co., Minn.: a large amount of damage has been done by locusts to the crops in this county. In some places these insects have eaten everything except wild grass and the foliage of trees.

Saint Paul, Minn., 7th: reports from various localities in southern Minnesota state that crops of all kinds have been injured by chinch bugs. At about midnight on the 13-14th, swarms of insects known as "day bugs" or "swamp bugs," infested the city, obscuring the gas lamps and covering the streets and pavements in many places from six inches to one foot deep. These insects disappeared after sunrise on the 14th.

Omaha, Nebr., 11th: reports from several sections of this state show that chinch bugs are causing serious injury to wheat, oats, and corn.

Quakertown, Bucks Co., Pa., 16th: during the earlier part of the month some injury was done by potato bugs and caterpillars in this county.

Morse, Johnson Co., Kans., 17th: chinch bugs are beginning to do injury in this locality; potato bugs have also appeared to some extent.

Mason City, Cerro Gordo Co., Iowa.: during a part of the afternoon of the 19th large swarms of chinch bugs filled the air so as to render walking in the streets very disagreeable.

Saint Peter, Nicollet Co., Minn.: large numbers of chinch bugs appeared in this vicinity on the 19th.

Campton, Kane Co., Ill., 22d: grasshoppers have injured the corn crop in this county.

Manhattan, Riley Co., Kans., 30th: chinch bugs have done considerable damage in this locality.

Humphrey, Cattaraugus Co., N. Y., 30th: grasshoppers are very numerous in this county.

Forsyth, Monroe Co., Ga., 31st: cotton worms are doing injury to cotton.

Embarras, Waupaca Co., Wis., 31st: chinch bugs are very numerous in this locality.

METEORS.

Earleton, Alachua Co., Fla.: two meteors were observed on the evening of the 11th; the first was seen falling due south at 8.30 p. m., and appeared as a large red ball, which separated into two parts, both disappearing before reaching the hori-

zon. The second meteor fell in a curve from north to southeast at 8.50 p. m.; beginning small, it grew rapidly larger and disappeared behind a cloud, but, by the bright light around the edges of the cloud, the observer could time the point of explosion.

Grand Junction, Greene Co., Iowa: a large meteor was observed at 8.30 p. m. on the 25th; it started in the northern sky and traveled due west for about 30°, leaving a bright trail in its path.

Topeka, Kans.: a large meteor was reported to have been observed at about 9 p. m. on the 25th; it was first seen in altitude 35° and azimuth 330°, having a slow and wavy motion, which the observer states resembled that of a ball when tied up in a handkerchief and thrown.

Des Moines, Iowa: an unusually bright meteor was observed at 9.30 p. m. on the 25th; it started at a point about 40° east of south, shot across the heavens at an altitude of about 30°, and disappeared when about 35° west of south.

Delaware, Walworth Co., Wis.: a large meteor was observed in the western sky at 8 p. m. on the 25th; it fell in a northwesterly direction, leaving a train of sparks.

Dubuque, Iowa: a meteor passed over this city from southeast to northeast at 12.05 a. m. on the 27th, leaving a bright trail which remained visible several seconds.

Cairo, Ill.: a brilliant display of meteors was observed in the western sky in altitude about 50°, between 12.30 and 1.00 a. m. on the 27th.

East Portland, Oregon: a very brilliant meteor was seen at midnight on the 29th; it moved in an easterly direction and exploded in the northeastern sky.

Meteors were also observed during the month on the following dates:

1st, Elkin, Ky.; Beverly, N. J. 2d, Vevay, Ind. 3d and 4th, Elkin, Ky. 5th, Manatee, Fla. 6th, Elkin, Ky. 7th, Clayton, N. J. 8th, Kalamazoo, Mich.; Quakertown, Pa. 9th, Beverly, N. J. 10th, Concord and Nashua, N. H. 11th, Duke and Archer, Fla.; Nashua, N. H. 12th, Independence, Iowa; Nashua and Concord, N. H. 13th, Stateburg, S. C.; Nashua and Concord, N. H. 14th, Keeler, Cal.; Dudley, Mass. 15th, Charleston and Pekin, Ill. 16th, Archer, Fla. 17th, Manatee, Fla.; Charleston, Ill. 19th, Charleston, Ill. 21st, Manatee, Fla. 25th, Davenport, Iowa; New Midway, Md.; Beverly, N. J. 26th, Delavan, Wis. 27th, Davenport, Iowa. 28th, Butlerville, Ind.; Independence, Iowa. 29th, Davenport, Iowa; Kalamazoo, Mich.; 30th, Davenport, Iowa; Kalamazoo, Mich.

MIGRATION OF BIRDS.

The Voluntary observer at Elkin, Clark Co., Ky., reports ducks flying northward on the 6th.

SUN SPOTS.

Mr. H. D. Govey, of North Lewisburg, Champaign Co., Ohio, reports having observed sun spots on the following dates: 1st to 3d, 5th to 7th, 10th to 16th, 23d to 30th; four large spots were observed on the 10th, extending in a straight line nearly across the centre of the sun.

SAND STORMS.

Sand storms were reported during the month, as follows:

San Carlos, Ariz., 3d; Fort McDowell, Ariz., 3d to 6th; Fort Mojave, Ariz., 4th to 7th; Rio Grande City, Tex., 29th, 30th.

VERIFICATIONS.

INDICATIONS.

The detailed comparison of the tri-daily indications for July, 1887, with the telegraphic reports for the succeeding thirty-two hours, shows the general average percentage of verifications to be 67.68.* The percentages for the different elements are: Weather, 67.52; wind, 65.96; temperature, 68.31.* By states, etc., the percentages are: For Maine, 59.52; New Hampshire, 63.82; Vermont, 61.18; Massachusetts, 66.28; Rhode Island, 75.75; Connecticut, 66.10; eastern New York, 61.23; western New York, 68.49; eastern Pennsylvania, 63.26; western Pennsylvania, 66.07; New Jersey, 67.84; Delaware, 65.00; Maryland, 66.62; District of Columbia, 66.22; Virginia, 64.60; North Carolina, 70.92; South Carolina, 71.46; Georgia, 69.98; eastern Florida, 68.74; western Florida, 70.91; Alabama, 69.94; Mississippi, 68.97; Louisiana, 71.38; eastern Texas, 81.68; Arkansas, 66.97; Tennessee, 60.85; Kentucky, 67.11; Ohio, 73.22; West Virginia, 76.05; Indiana, 75.61; Illinois, 77.63; lower Michigan, 69.10; upper Michigan, 64.08; Wisconsin, 65.04; Minnesota, 66.23; Iowa, 70.66; Kansas, 67.54; Nebraska, 55.06; Missouri, 76.28; Colorado, 58.23; eastern Dakota, 59.68; Washington Territory, 80.80; Oregon, 85.04; northern California, 91.61; southern California, 93.44.

There were fifteen omissions to predict out of 8,529, or 0.18 per cent. Of the 8,514 predictions that have been made, eight hundred and thirty-seven, or 9.83 per cent., are considered to have entirely failed; seven hundred and thirty-three, or 8.61 per cent., were one-fourth verified; 2,018, or 23.70 per cent., were one-half verified; 1,565, or 18.38 per cent., were three-fourths verified; 3,361, or 39.48 per cent., were fully verified, so far as can be ascertained from the tri-daily reports.

The predictions for all districts east of the Rocky Mountains for July, 1887, were made by 2d Lieutenant John P. Finley, Signal Corps, Assistant, except from the 17th, 3 p. m., to the 19th, 10 p. m., inclusive, when they were made by 2d Lieutenant F. M. M. Beall, Signal Corps, Assistant; those for the Pacific coast districts were made by 2d Lieutenant J. E. Maxfield, Signal Corps, Assistant; the verifications were determined by 1st Lieutenant Robert Craig, 4th Artillery, Acting Signal Officer and Assistant.

CAUTIONARY SIGNALS.

Of the total number of signals ordered during July, 1887, it was practicable to determine the justification or failure of seventy-five; of these, twenty-six, or 34.66 per cent., were fully justified both as to direction and velocity. Number of signals ordered for southeast winds, five; fully justified both as to direction and velocity, three, or 60.00 per cent. Number of signals ordered for southwest winds, twenty-two; fully verified both as to direction and velocity, ten, or 45.45 per cent. Number of signals ordered for northwest winds, six;

* In determining the general average percentage and the percentages for the different elements, the Pacific coast states have not been included.

fully verified both as to direction and velocity, five, or 83.33 per cent. Number of signals ordered without regard to direction, forty-two; verified, eight, or 19.05 per cent. Number of signals ordered late, i. e., after justifying velocity had begun, one, or 1.33 per cent.

In addition to the above, there were ordered at display stations sixty-nine signals, the verification of which it was impracticable to determine.

In forty-two instances winds were reported which would have justified the display of cautionary signals, but for which no signals were ordered, and in eleven instances winds which would have justified the display of on-shore signals, but for which no signals were ordered. The display of on-shore signals was discontinued on July 13th.

No cold-wave signals were ordered during the month.

LOCAL VERIFICATIONS.

The following is from the report of the "Michigan State Weather Service" for July, 1887:

Weather signals are now displayed in one hundred and thirty-two towns in the state, and are very favorably commented on. The prediction of the weather for the twenty-four hours from 7 a. m. to 7 a. m. has been verified during July as follows (the verification is taken from reports of displaymen furnished monthly to this office): temperature, 82.9 per cent.; weather, 85.7 per cent.; temperature and weather, 84.3 per cent.

The weather and temperature signals are now carried on the baggage cars of the following roads: D., G. H. & M. R'y., C. & G. T. R'y., Port Huron Division G. T. R'y., P. H. & N. R'y., the Michigan Central R'y. System, G. R. & I. R'y., and the Chicago and West Michigan R'y. The first trains leaving the terminal points carry the signals, and there are now twenty-five trains on these different roads that carry the signals, and cover a very large portion of the agricultural district of the state, and bring the benefits of the service within reach of the farmers along the line of these roads daily, and many favorable comments are made on the benefits derived.

The percentage of verification of weather predictions for July on the D., G. H., and M. R'y., is 84.7 for weather and 83.3 for temperature; on the C. & G. T. R'y., weather, 81.3, and temperature, 79.7; P. H. & N. R'y., weather, 85.0, and temperature, 84.7. The other roads have not been carrying the signals sufficient time to compute the percentage.

The following is from the July, 1887, report of the "Minnesota Weather Service:—"

Verifications of weather signals for Minnesota were 77 per cent. for weather and 75 per cent. for temperature; for eastern Dakota, 85 per cent. for weather and 88 per cent. for temperature.

The following is from the July, 1887, report of the "South Carolina Weather Service:—"

The percentage of verification of the weather and temperature predictions for the whole state was: for weather, 84.8 per cent.; for temperature, 94.6 per cent.

The following is from the July, 1887, report of the "Tennessee State Board of Health Bulletin:—"

The percentage of verification of the temperature and weather predictions during the month at Fayetteville and Clarksville were as follows: Fayetteville, temperature, 100 per cent.; weather, 71.0 per cent.; Clarksville, temperature, 87.1 per cent.; weather, 55.0 per cent.

STATE WEATHER SERVICES.

The following extracts are republished from the reports for July, 1887, of the directors of the various state weather services:

The "Arkansas Weather Service," W. U. Simons, Signal Corps, director:

The month was marked by numerous local rain storms, which were distributed in a partial manner, some parts of the state having abundant daily rains, others only at intervals of several days, and in some localities only one or two sprinkles during the month, so that the total amount ranged from 8.7 inches to only .04 of an inch. These rains did not appear in belts, and it would be difficult to precisely define their location. The greatest amount of rain fell at

Forrest City, in the eastern part of the state, while the next largest amount was reported from Pine Bluff in the central part, and the least at Malvern, also centrally located.

The temperature was apparently above the average at most points, but more particularly in the central and northern portions than in the southern. The temperature reached or passed 90° on over twenty days of the month at all stations except Eureka Springs, where it reached 90° on three days; at Conway on fourteen days; Portia, fifteen days; Buck's Range, seventeen days; Washington and De Vall's Bluff, each on eighteen days.

A cool wave passed over the entire state on the 23d, and there were but few points where the temperature reached 90° on that day. The highest temperature reported during the month was 109°, at Lead Hill, on the 30th, but a maximum of a hundred or over was reported from twenty-six stations. The highest temperatures of the month were observed on the 30th and 31st at most points.

There was no general storm during the month, and but one or two local wind storms; these did but little damage.

Hail was reported in Marion county on the 31st, and a very heavy thunder-storm, with particularly brilliant lightning.

The "Monthly Review of the Illinois Weather Service,"
Col. Charles F. Mills, director:

The month of July, 1887, was notable for its extreme heat, deficient rainfall, lack of cyclonic disturbances, and consequent casualties.

The mean temperature, eighty degrees, was four degrees above the normal temperature for the month, and is the highest mean temperature recorded in the past thirteen years. The maximum temperature, 110° was reported by a number of observers in the northern division of the state, and is six degrees above the highest July maximum temperature recorded in the past ten years. The minimum temperature of the month, forty degrees (with light frosts), was reported on a. m. of the 4th from De Kalb county, making the absolute range of temperature for the month seventy degrees, which is about fifteen degrees above the average monthly range for July. The extreme heated periods were from the 12th to 18th and 27th to 31st.

The rainfall was greatly deficient in the majority of the seventy counties reporting, twelve of which reported a total monthly rainfall of three inches and above; forty-eight reported from one to three inches; eight, less than one inch, and two, Vermillion and Effingham, reported no rainfall. General rains fell throughout the state from 1st to 3d, the amount deposited on these dates being greater than the total for the remainder of the month. The cool-wave of 22-23d was accompanied by heavy local showers in sections of the central and throughout the northern part of the southern division. Owing to the long-continued drought, in many sections the water supply is very scarce; creeks and wells running dry that were never known to fail, and stock suffering greatly in consequence.

The percentage of sunshine for the month was considerably above the July normal percentage, as computed from the records of the past seven years. An average of only three cloudy days was reported from the central division. The prevailing winds were southerly, and the average hourly velocity but six miles.

The "Indiana Weather Service," Prof. H. A. Huston, of
Purdue University, Lafayette, director:

The pressure for July was about normal, being slightly below in some localities, and slightly above in others. The range was small, though not remarkably so. The greatest was .400 at Indianapolis and Worthington, and the least was .320 a Spiceland.

The temperature for the month has been extraordinarily high, the mean for the state being 5° above the normal. At twenty-one stations the maximum reached or exceeded 100°, while at all the rest it reached 99°. At several stations a maximum of 105° was reported, while at Butlerville 106° was reported. The latter temperature has never been exceeded at any station of the State Weather Service, and has only once been reached—at Logansport in 1874. At Indianapolis it has been the hottest July in seventeen years, being 4° above the mean of that period. The total number of degrees at that station was, on the 1st of August, 142° above the normal since the beginning of the year. In Wisconsin, Illinois, and Ohio the same conditions prevailed. At Milwaukee the mean for the month was only once exceeded in seventeen years, and then only three-tenths of a degree—in 1878, while the means of all the other years have been considerably lower. At Springfield, Ill., it was the hottest July in eight years, and at Toledo, Ohio, the hottest in seventeen years. This extreme temperature prevailed in a stretch of country embracing the states of Ohio, Indiana, Illinois, Wisconsin, Iowa, Nebraska, Missouri, and Kansas, in fact the great corn-growing states of the Union. South of this tier of states, however, the temperature was nowhere exceptionally high, seldom exceeding the normal.

The precipitation for the month was much below the normal, nearly three inches for the whole State. As the June precipitation was also short about the same amount, the accumulating deficiency has become quite a serious matter. The total deficiency at Indianapolis since January 1, was, on August 1, 9.58 inches. This is probably about the average for the state, and represents an enormous aggregate deficiency—nearly half a million tons to the square mile. At Indianapolis there has been only one July in seventeen years in which the rainfall has been less than this—that was in 1881, when it was 0.82 inch. It is a curious fact that at this station more rain fell during this month in the five years ending 1875 than in the twelve succeeding years up to date. It is held by some that there is a periodicity in these terms of drought and copious rainfall, but, for so far, observation does not support such a theory—no reliable approach to periodicity has yet been discovered. The peculiar atmospheric conditions that produce drought areas from time to time in various parts of the United States are not well understood, and much has yet to be learned in that direction. Why the states of Illinois, Indiana, and Ohio should thus, this year, be parched and burned up for lack of rain, while the states to the south and northward have an average, or more than average, precipitation is a meteorological problem that yet needs a satisfactory solution.

At a few stations heavy showers were reported during the month, principally on the 4th and 21st. Muncie had 1.95 inches on the 4th, Farmland 1.07 on the same date. Richmond had 1.45 inches on the 21st, and Worthington 1.38 inches. Thunder-storms were reported on the 1st, 2d, 3d, 4th, 5th, 6th, 7th, 8th, 9th, 18th, 19th, 28th, and 31st, but none of them were very noticeable. Hail was reported at Muncie and Logansport on the 18th. The observer at Mauzy reports a gale on the 9th which blew down fences and trees in his vicinity.

Solar halos were reported at Mount Vernon on the 16th and 20th, and lunar at Vevay on the 3d, 5th, and 7th.

A very bright meteor was observed at Fortville on the 30th at 9 p. m. It started near Cassiopia and seemed to descend nearly vertically, and left a very perceptible luminous train behind it. The observer at Vevay reports another on the 2d at 8.30 p. m., very brilliant, radiating from Leo and passing south through Aquila, and leaving a luminous train visible ten seconds.

The "Iowa Weather Service," Dr. Gustavus Hinrichs, Iowa
City, director:

July, 1887, was very hot, fine dry weather with southerly winds or calms prevailing. Thunder-storms and rains were frequent but generally very local.

The mean temperature of the air was 3° above normal. During the past forty-eight years, July has but once been hotter in Iowa, namely in 1868. July was nearly as hot as this year in 1864, 1854, and 1845; in 1886, 1881, and 1878 it reached to within one degree of this year's temperature.

All three decades of the month were above normal; the last by 1° 0, the first by 2° 5, and the middle decade by 7° 0, which thereby ranks among the hottest decades on record. The temperature rose gradually from the 11th to the 17th, and from the 26th to the 29th; on these hottest days, heat storms with rain, thunder, and lightning, and locally high wind and hail set in, greatly lowering the temperature. The storm of the 17th was most intense in southeastern Iowa, while that of the 29th was most marked in the north-east.

Although the heat was very protracted, and on several days reached close up to the highest ever observed, we have heard of only one case of fatal sunstroke in Iowa. In other parts of the United States fatal sunstrokes were numerous, especially on Sunday the 17th. The reason of this immunity from fatal effects of heat in Iowa is the present great dryness of our air; the relative humidity on the hottest days came down to 30 per cent. Hence the apparently strange fact that threshing machines were kept running in Iowa while the thermometer ranged high in the nineties, without fatal effects to man or beast.

The sky was generally fine, the mean cloudiness being fully 25 per cent. below the normal, which itself is low for our mid-summer. Half of the days were clear, and none were entirely cloudy.

The wind was light, southerly winds and calms greatly predominating. High winds were local, and mainly limited to the 12th, 17th, and 29th.

The rainfall was generally considerably below normal in amount and on the whole came in local showers only. It rained in the state on twenty-one days, or on two out of every three days, so that the rain frequency for the entire state appears high. But on only eight of these days did the rain extend to about half of the stations reporting, and on no day did it rain throughout Iowa. The only parts of Iowa which received the normal amount of July rains form a belt from Sac over Hancock to Mitchell county, and a large area covering most of Buchanan, Benton, Linn, Iowa, and Johnson counties, where from four to six inches of rain fell. From these regions of full normal rainfall, the amount diminishes in all directions, remaining fairly satisfactory in the north and east, and running down to less than two inches in southern and middle-central parts of Iowa. In portions of southeastern Iowa, even less than one inch fell.

Flowing water, and especially ground water, has been very low. Creeks that never have been known to be dry before, have become so now, so that it is often very difficult to provide water for stock. This is due to the drought of last year having left the ground dry; this year's rains, if no drought had preceded, would have been sufficient to maintain a fair supply of water in creeks and springs.

The number of thunder-storms was high, corresponding to the frequency of local rains. Much damage has been done to property, and many cattle, horses, and several men have been killed by lightning.

Extended fogs prevailed on the 2d in the west, on the 19th in the southeast local fogs were more frequent.

A notable meteor was seen at about 8.30 p. m. on the 25th, in central Iowa and as far east as Iowa City. Northern lights were reported on the 6th.

The "Kansas Weather Service," Prof. J. T. Lovewell,
Topeka, director:

The hottest July since 1874. Only two Julys on our record have been hotter, (1868 and 1874), and no preceding July has had so cloudless a sky. The rainfall was a little less than half the July average, and nearly the entire amount fell on the first day of the month. This deficiency in the rainfall, added to the serious shortage of the preceding twelve months, found the growing crops without the usual ground reserve to draw upon, and great damage has resulted, especially to the corn crop. We are now passing through a period of rain deficiency, one of which, according to our observations, occurs once in about seven years, each alternate period being one of maximum deficiency.

Mean temperature.—79° 79, which is 1° 80 above the July average. The highest temperature was 102°, on the 17th; the lowest was 55° 5, on the 24th, giving a range of 46° 5. The mercury reached 90° eighteen times. Mean at 7 a. m., 74° 85; at 2 p. m., 90° 81; at 9 p. m., 76° 74.

Rainfall.—2.14 inches, which is 2.23 below the July average. Rain in measurable quantities fell on seven days. There were four thunder showers. The entire rainfall for the seven months of 1887 now completed has been 15.92 inches, which is 5.15 inches below the average for the same months in the preceding nineteen years.

Mean cloudiness.—24.19 per cent. of the sky, the month being 18.76 per cent. clearer than usual. Number of clear days (less than one-third cloudy), 21; half clear (from one to two-thirds cloudy) 9; cloudy, more than two-thirds, 1. There were 3 entirely clear days and none entirely cloudy. Mean cloudiness at 7 a. m., 27.42 per cent.; at 2 p. m., 27.10 per cent.; at 9 p. m., 18.06 per cent.

The "Michigan Crop Report" (the state weather service is in charge of N. B. Conger, Sergeant, Signal Corps, at Lansing):

The meteorological features of the state are based upon the reports received from thirty-seven voluntary observers and eight of the United States Signal Service. Several valuable reports were not received this month in time to be used in this report.

Temperature.—The temperature for July has been above the normal. The mean temperature for the state, 74°.0, is 5°.5 above the normal. The mean temperature for the Upper Peninsula, 64°.4, is 1°.1 below the normal, while for the Southern Peninsula the mean temperature is from 3°.1 in the northern counties, to 6°.4 in the southern counties, above the normal. The mean daily maximum temperature for the state is 85°.6.

A hot wave passed over on the 15th, 16th, and 17th, when temperatures were recorded above 100°, the maximum temperature being 102°, at Marshall, on the 17th, and at Three Oaks on the 14th, 17th, and 20th. The maximum temperatures at several stations were recorded above 90° on twenty days of the month. The highest monthly mean maximum temperature, 93°.3, is reported at Hudson.

On the evening of the 23d the temperature, which had been high for the past ten days, began to fall, and reached the minimum on the morning of the 23d, of 86°.7, at Gaylord. Frost was reported from several stations in the northern part of the state. The temperature began to rise again on the 24th, and continued high for the remaining portion of the month.

Precipitation.—There has been a deficiency of rainfall in the central and southern sections, and a slight excess in the northern section and Upper Peninsula. The normal rainfall for July, for the state, is 3.32 inches, while the average has been but 2.07 inches, showing a deficiency of 1.25 inches. In the southern section the deficiency is 1.50 inches, and the central section is 1.57 inches.

Rain fell generally in the state on the 1st, 2d, 3d, and 4th, while the southern tier of counties received some on the 5th. On the 9th general rains fell, and the central section records rain on the 12th and 18th. On the 21st occurred the last general rain, and the central section records rain on the 22d in some localities, and Macomb county reports rain on the 23d. From the 22d to the 31st, however, there occurred no appreciable amount of rain in the southern and central counties, except Macomb county, on the 23d, and the drought has been severely felt in these sections.

Bay, Clinton, Allegan, Macomb, Kalamazoo, and Washtenaw counties record less than one inch of rainfall for the month.

Decatur, Van Buren county, and Chelsea, Washtenaw county, record no rain as fallen since the 4th.

Summary.

Monthly mean temperature, 74°.0; mean of maximum temperature, 97°.1; mean of minimum temperature, 47°.7; mean monthly range of temperature, 49°.4; highest temperature, 102°.0, at Marshall, date 17th; Three Oaks, date 14th, 17th, 20th; lowest temperature, 36°.7, at Gaylord, date 23d; monthly range of temperature, 65°.3.

Mean monthly rainfall, 2.07 inches.

Average movement of wind, 5,263 miles; maximum velocity and direction, 37 miles, southwest, at Mackinaw City, date 30th; average number of clear days, 14.5; average number of fair days, 12.4; average number of cloudy days, 4.1; average number of days on which .01 inch of rain fell, 8.9.

Light frosts were reported at the following stations on the 23d: East Tawas, Gaylord, Harrison; Mackinaw City, and Swartz Creek.

The "Minnesota Weather Service," Prof. Wm. W. Payne, Carleton College, Northfield, director:

The dominant features of the month were a deficiency of rainfall in the southern counties, an excess in the northern, and a temperature slightly above the normal. From the 1st to the 16th there was an excess of temperature and a slight excess of precipitation; for the week ending the 23d there was a deficiency of precipitation and a temperature slightly above the average; from the 23d to 31st, there was a lack of precipitation and an excess of temperature. At the close of the month harvesting was progressing rapidly as far north as the forty-seventh parallel. The tornadoes of the 25th, 26th, and 29th did some little damage in the vicinity of Moorhead. In some localities the oat, barley, and wheat crops were reported below the average from the effects of the dry, hot weather and chinch bugs.

Temperature.—This has varied from about normal at Saint Vincent and Duluth to 2° above at Moorhead and Saint Paul, and 1° above at La Crosse. The average temperature for the state is 72°.4; this is, respectively, 0°.2 and 1°.5 above that of the corresponding month of 1886 and 1885, and 4°.1 warmer than the preceding month of June. The warmer periods of the month were the 5th to 11th (inclusive), 13th to 16th, 19th, 25th, 29th, 31st; the maxima

temperatures occurred mainly during the second of these periods. The highest reported in the state was recorded on the 15th at Pine River Dam, and was 101°; Sherburne followed with a maximum of 100° on the 11th, 16th, and 26th, while for the year previous it was 107°. At Spring Valley the maximum was 98° on the 15th and 16th, and for the preceding year 104°. At La Crosse the maximum of 98°.4, registered on the 16th, is the highest recorded since July, 1874. The dates on which the lowest temperatures were reported are the 2d, 9th, 10th, 18th, 20th to 23d (inclusive), 25th and 30th. The minimum temperature for the state is 37°, and was recorded at Pokegama Falls on the 23d; on the same date it was 39°.5 at Park Rapids, and 38°.1 on the day preceding at Saint Vincent. The minimum temperature is 7° lower than reported at any place during July, 1886, and the average of the minima temperatures for the state is 3°.2 lower. The monthly range of temperature for the state is 64°; the greatest range for any station is 58°.3, and occurred at Moorhead, while at Bird Island and Pokegama Falls the range was 55°.0. The least monthly range was 37°, and was reported from Lake Winnibigoshish and Rolling Green.

Precipitation.—The average for the state (in inches) is 3.35; this is 0.51 above that of the corresponding month of 1886, and 1.27 below that of 1885. The rainfall was fairly well distributed in the northern counties, where there was an excess, while in the southern counties there was a deficiency, which was most marked in the southeastern portion of the state; at Grand Meadow the total precipitation was only 1.43, while at La Crosse it was 1.77; at the latter station the fall was 2.88 below the average of fifteen years. The greatest precipitation was generally reported from the region of the Red River Valley and the Great Woods. Some of the heaviest total monthly falls reported were Moorhead, 6.40; Pine River Dam, 5.94; Pokegama Falls, 5.29; Leech Lake, 4.46; Lake Winnibigoshish, 4.40; Saint Vincent, 4.28; Duluth, 4.17; and Saint Paul, 3.89. This is 1.08 above the average at Moorhead, 1.37 above at Saint Vincent, 0.60 above at Saint Paul, and 0.25 above at Duluth. The dates on which precipitation was general are 1st to 4th (inclusive), 8th, 9th, 11th, 12th, 14th to 16th, 21st, 26th to 29th. Stations reporting an inch or more of precipitation, with the dates, and which fell mainly during the prevalence of thunder-storms, were: Moorhead, 1.03, 14th; Saint Vincent, 1.91, 8th, and 1.04, 14th; Duluth, 1.33, 4th; Saint Paul, 1.13, 1st; Lake Winnibigoshish, 1.50, 16th; Leech Lake, 1.21, 16th; Morris, 1.06, 3d; Red Wing, 1.00, 12th; Excelsior, 1.05, 27th; Pine River Dam, 1.12, 3d; Mankato, 1.00, 13th.

The "Mississippi Weather Service," Prof. R. B. Fulton, of the University of Mississippi, Oxford, director:

Summary.

Mean temperature, 82°; normal for July, 80°.5; highest, 102°, at Hermanville, on the 20th, and at Lake, on the 19th; lowest, 63°, at Corinth, on the 2d; absolute range of temperature, 39°.

Average depth of rainfall, 4.38 inches; greatest monthly rainfall, 8.29 inches, at Hermanville; least monthly rainfall, 0.40 inch at Corinth.

Rainfall has been generally abundant throughout all the states. A few small sections in Mississippi report a deficiency, but there has been enough to keep the crop in good condition.

Cotton and corn crops are reported as being better than for years.

While throughout the northern and eastern states the temperature for July was from two to five degrees above normal, it was very nearly normal throughout Mississippi.

The "Missouri Weather Service," Prof. Francis E. Nipher, of Washington University, Saint Louis, director:

The mean temperature for July, 1887, has been 82°.5, which is 3°.3 above the normal temperature. The month was hot throughout, the second decade being the hottest, while the first was somewhat cooler than the third. The highest temperature was 98°.8, on the 7th, and the lowest was 69°.6, on the 24th, this being the only day during the month that the temperature fell below 70°. The temperature rose to and above 90° on eighteen days during the month. The mean temperature of the past month has been exceeded but twice since 1837, viz., July 1854 and 1868, when the mean was 84° and 84°.3, respectively.

The rainfall at the central station was 2.70 inches, which is 1.89 inches below the average for July at Saint Louis. About two inches of this fell at the beginning of the month.

In the state the highest temperatures reported were: 109° at Pro Tem; 108° at Mexico; 106° at Louisiana; 104° at Sedalia and Troy; 103° at Miami; and 102° at Kirksville and Steelville. The lowest temperatures were: 54° at Oregon; 55° at Louisiana; 56° at Ironton, Kirksville, and Miami; and 56°.5 at Houstonia. The highest mean was 82°.9, at Columbia, and the lowest was 71°.3, at Springfield.

The rainfall has been below the average all over the state, excepting two small areas, one in the northeast part of the state and the other in the southeast part, where the fall was four inches. The lowest rainfall is reported from the station at Mexico, 0.73 inch, it being the only station having less than one inch.

The observer at Oregon reports the late corn is parched so badly now that rain cannot restore it. Early corn is matured and will produce an average crop of forty bushels per acre. Spring wheat and oats matured well and are turning out better than usual. Fall wheat yields below the average.

The "Nebraska Weather Service," Prof. Goodwin D. Swezey, of Doane College, Crete, director:

The month of July has been characterized by the continuance of the dry weather of the season and by the occurrence of the hottest day for ten years.

Precipitation.—Except along the lower Platte and Loup Rivers, and thence northward along the Missouri, the rainfall has been very meagre, from an inch and a half to three inches; the largest amount reported is 5.95 inches at West Point. The average for the whole state is 2.77, while the normal for July is 4.20, as deduced from the past ten years. The distribution in time has not been so far out of the way, the number of rainy days being 7.7 against a normal of 7.9, but, in general, the ground had become so dry and hot that the smaller amounts received did not do their work. It is to be noted that for a whole year preceding this month, the monthly rainfall has been almost regularly below the normal amount, as will be seen from the following table:

Rainfall.

Month.	Actual.	Normal.	Month.	Actual.	Normal.
1886.	Inches.	Inches.	1887.	Inches.	Inches.
July.....	1.31	4.82	January.....	.46	.88
August.....	2.97	3.97	February.....	1.06	.92
September.....	3.59	2.69	March.....	.36	1.11
October.....	1.25	2.47	April.....	1.62	2.81
November.....	1.26	.96	May.....	3.04	4.26
December.....	.90	.82	June.....	4.24	4.97
			Total.....	22.06	29.78

In other words, the soil entered upon its season of summer heat and drying this month with about seven and one-half inches less of rainfall since the preceding summer, than the normal amount, making it, on the whole, one of the most trying seasons for crops, young trees, grass, etc., that we have experienced since "grasshopper days." In fact, we must go back to March, 1886, with its unprecedented snowfall, to find a month with precipitation notably above the normal.

Temperature.—The mean temperature has not been greatly above the normal, about one degree. The noon temperature has been 3° above the normal, and the maximum temperature on the afternoon of the 29th reached 103°, both at Crete and Omaha, a temperature higher than any before reported for the ten years that our records have been kept. The lowest temperature of the month, 47°, is also lower than any reported during that period.

Wind.—On the afternoon of the 29th, before mentioned as the hottest day on record, the only tornado that has done any serious damage in the state for a number of years swept David City, killing several persons and destroying a considerable part of the town.

There has been a notable lack of thunder and hail storms, no hail, in fact, being reported from any part of the state. The clouds have been light and fleecy, and there have been but three days on the average in which the sky would be designated cloudy.

The "New Jersey Weather Service," Prof. George H. Cook, of the Agricultural College, New Brunswick, director:

The month has been characterized by excessive heat and humidity and violent storms. The largest rainfall reported for the month was 15.29 inches at Hightstown. On the 22d, 5.40 inches fell at Matawan, causing damage to the amount of \$10,000. At Phillipsburg, Warren Co., on the night of the 23d, a very severe thunder-storm occurred. The lightning struck a smokestack on the Delaware Rolling Mill, and it fell against another high stack and both crushed in the roof over the hot furnace. A heavy shaft in the mill was also cut in two by the lightning. The Judd carriage factory near by was completely demolished. Hamlin's barn was blown over and four horses were buried in the ruins. A car loaded with ice, on the Lehigh Valley Railroad, was blown down an embankment, and several houses in different parts of Phillipsburg were unroofed and many trees were uprooted. The damage, so far as known, will not be less than \$20,000.

The mean temperature at ten stations as compared with normals determined from past records of New York City, Atlantic City, Paterson, Newark, South Orange, Somerville, Moorestown, Philadelphia, Lambertville, and New Brunswick, shows an excess of heat received during July of 3°.3.

The "New England Meteorological Society," Prof. Wm. H. Niles, of the Institute of Technology, Boston, Massachusetts, president:

The month as a whole has been unusually warm and wet, and as a consequence, sultry and oppressive. The greatest heat was during the first four days, in continuation of the hot weather at the end of June; the coolest days were the 11th, 15th, 16th, and 21st, the minimum of the month occurring generally on the second or last of the dates mentioned. The heaviest rain fell on the 23d and 24th; thunder-storms were frequent and severe, and many foggy days are reported.

Mrs. E. J. Doton reports from Woodstock, Vt., in continuation of the records of the late Hosea Doton, that July, 1887, is the warmest month for the last nineteen years. Mr. H. D. A. Ward, of Middletown, Conn., compares the daily means of July, 1887, with the daily means of twenty-nine Julys, and finds an excess on all but six days; the mean of the month is higher than that of all previous records, except for July, 1868, when the mean was 74°.62.

The weather of the month may be considered under eleven alternating dry and wet periods, as determined by barometric changes.

(1) The heat of the end of June continued during the first four days of July, while the pressure was higher to the south, and most stations had their highest maximum on the 2d. The maximum temperatures at several stations are of interest.

Stations.	1st.	2d.	3d.	4th.	Stations.	1st.	2d.	3d.	4th.
Shelburne, N. H.....	91	96	83	94	Bar Harbor, Me.....	86.5	91	85.8	81.8
Nashua, N. H. a.....	92.3	96.7	93.3	90	Manchester, Mass.....	88.5	78	82	74
Woodstock, Vt.....	94	96	92	92	Nantucket, Mass. a.....	80	78	80	83
Amherst, Mass.....	91.6	93.6	91	87.8	Nantucket, Mass. b.....	79.2	73.5	73.9	77
Framingham, Mass.....	94	96	97	89	Newport, R. I.....	77.5	75.5	79	75
Hartford, Conn.....	91.5	95	93.7	88	New London, Conn.....	86	85	84	82

(2) With the approach of a faint cyclonic disturbance on the 5th and its passage over Canada on the 6th, rains were reported at many stations until the 7th; this, however, caused little relief from the heat as the winds were still southerly. (3) The 8th was generally fair and warmer, before (4) the arrival of another moderate cyclone, that came from the Lakes on the 9th, and passed over New England on the 10th, causing numerous showers and some violent thunder-storms until its northwesterly winds on the 11th brought fair and temporarily cooler weather. (5) The fair weather lasted from the 12th to the 15th; warm at first, when the pressure was highest in the south, and thus those stations that had not reached their month's maximum on the 2d found it on the 13th, when temperatures from 88° to 96° were generally recorded; then the approach of an anti-cyclone over the Lakes on the 14th, and across New England on the 15th, brought northwesterly winds and moderate temperatures, and minima as low as 50° in the northern valleys, and 55° to 60° in the south on the early morning of the 16th; this was the lowest of the month at many stations.

(6) During the 16th, 17th, and 18th, the greater part of New England fortunately escaped the extreme heat that affected the states to the south and west. High pressure on the southern states drove the air northward, and the temperature rose from 95° to 100° in Philadelphia and cities to the westward, but excepting in southwestern Connecticut, few of our stations reported maxima above 85°, and many had during this period no maximum over 80°. This was in great part due to the passage of a gentle cyclonic disturbance from Canada over New England, giving us southeasterly or easterly winds, rain and thunder-storms, while the rest of the country had light southwesterly winds and scorching sunshine. (7) Fair weather followed, with moderate temperature on the 19th and 20th.

(8) A wet period from the 21st to the 24th, caused by the passage of a cyclone from Illinois over the Lakes and Canada, maintained moderate temperatures and gave excessive rainfall to certain stations; the largest measures are here quoted:

Stations.	23d.	24th.	21st to 24th.
	Inches.	Inches.	Inches.
Deerfield, Mass.....	1.02	5.39	7.51
Northampton, Mass.....	0.89	5.51	7.16
Manchester, N. H. a.....	2.93	3.75	7.49
Manchester, N. H. b.....			7.08
Manchester, N. H. c.....	2.60	2.57	5.71
New Hartford, Conn.....			6.72
Boyd's Corners, N. Y.....	6.01	3.00	10.09

Thunder-storms were generally reported on the 23d and 24th.

The remaining days of the month may be considered as (9) warm and generally fair from the 25th to the 28th, but with showers on the 26th and 28th; the distribution of pressure during this period being ill-defined, except in the Gulf states, where a cyclone hovered about for several days; and (10) showery and hot on the 31st, when a faint cyclone passed north of us over Canada. Many thunder-storms occurred during these two periods, the storms of the 31st being especially severe in Connecticut.

Auroras were recorded at a few stations on July 13th, 15th, 18th, 19th and 20th.

A small but brilliant meteor was seen by Mr. Higgins at West Milan, N. H., on the night of July 3d, moving from northwest to southeast.

"Oregon Weather Service," report prepared by B. S. Pague, Private, Signal Corps:

Temperature.—The temperature has been nearly normal throughout the state. A warm period extended over the state from the 5th to 8th; a cool period from the 12th to 18th. A noticeable feature is the fact that during the extreme heat prevailing throughout the east on the 16th and 17th, here we had our coolest period. The highest temperatures recorded were 106° at Umatilla on the 19th, and 103° at Ashland on the 8th; the lowest recorded were 26° at Fort Klamath on the 14th and 15th. A special characteristic of the temperature in the valleys was the few extreme warm days, and the great number of cool days. The nights were more than usually cool.

Rainfall.—The rainfall was below the average. An occasional shower fell along the Columbia from Portland to the ocean, but no rain in the Willamette Valley. One shower fell in the Umpqua Valley; from one to three showers in the Rogue River valley and the southern counties through the lake region; more rain fell in this latter section than in any other part of the state. Oc-

casual showers fell along the coast, and light sprinkles in the eastern part of the state.

Winds.—The winds were generally light to fresh from a westerly direction.

Frosts.—Occasional frosts are reported at Fort Klamath from the 11th to 25th, and a very light frost at Baker City on the 13th. At East Portland light frost occurred from the 10th to 14th, inclusive. Frosts occurred in the mountain regions or along the foot hills from 12th to 17th; they were light and no damage is reported. Frost in July is unusual.

The "South Carolina Weather Service," Hon. A. P. Butler, Commissioner of Agriculture for South Carolina, director:

The month has been chiefly remarkable for the unusually high temperature which prevailed during the second decade, and for the abundant rains which occurred during the closing days.

The temperature began to rise on the 12th, on which date Hampton and Bennettsville reported maximum readings of 100° each. On the following day, 13th, the maxima were: Hampton, 103°; Bennettsville, 101°; Brewer Mine, 100°; and Chester, 104°. The temperature continued to increase over all sections of the state until the 18th and 19th, on which dates the highest temperatures of the month were reported.

At Charleston the mean temperature, 81°.7, was slightly below the average of the last sixteen years. In the rest of the state it was normal or slightly above.

The heavy rains of the 29th and 30th were caused by the passage of a cyclone which formed in the Gulf of Mexico prior to the 27th; on that date it was central near Pensacola, Fla., whence it moved north-northeastward into Alabama. From the 29th until the 31st the cyclonic area increased and spread over Alabama, Georgia, South Carolina, and northern Florida, and was attended by heavy rains, with tornadoes, in Alabama, Georgia, and our state.

Summary.

Mean temperature for the state, 82°; highest temperature, 110°, at Chester, on the 18th; lowest temperature, 60°, at Spartanburg on the 1st and 3d; range of temperature, 50°; greatest daily range of temperature, 39°, at Spartanburg, on the 1st; least daily range of temperature, 2°, at Newberry, on the 29th.

Mean depth of rainfall, 7.49 inches; greatest monthly rainfall, 13.62 inches, at Blackville; least monthly rainfall, 2.79 inches, at Jacksonborough; greatest daily rainfall, 3.70 inches at Abbeville on the 30th; least daily rainfall, trace (amount inappreciable), at Spartanburg and Abbeville on the 18th, and at Anderson and Hampton on the 19th.

Average number of rainy days, 14.4.

The following is an extract from the report of the "Meteorological Department of the State (Tennessee) Board of Health,"

prepared under direction of J. D. Plunkett, M. D., President of the State Board of Health, by H. C. Bate, Signal Corps, Assistant, Nashville:

The month of July presented the usual amount of electrical disturbances, but the principal feature was the excessive and unprecedented heat during the latter half of the month.

The mean temperature was 78°.8, considerably above the normal, and the highest mean for many years. The minimum was 56° recorded on the 1st, and was the highest July minimum since 1883. The hot wave which came about the 10th, culminated generally about the 17-19th, but continued with a slight relaxation until the close of the month, and was the longest warm spell ever known. The ranges of temperature were about the normal.

The precipitation was rather below the average, the mean being 3.32 inches; of this amount, the eastern division received an average of about four inches, and the other two divisions about three inches. The week of the 14-20th was the "dry week," and with the exception of a few local rains in east Tennessee, and two or three in the western part of the state, there was a serious absence of precipitation. It was during this period that the hot wave culminated and was so severely felt. Many of the rains were attended with severe electric storms, some of which were very destructive to life and property. The proportion of cloudiness was about the normal.

Summary.

Mean temperature, 78°.8; highest temperature, 101°, on the 18th and 30th, at Milan, and on the 29th, at Austin; lowest temperature, 56°, on the 1st, at Farmingdale; range of temperature, 45°; mean monthly range of temperature, 31°.1; greatest monthly range of temperature, 42°, at Farmingdale; least monthly range of temperature, 25°, at Waynesborough; mean daily range of temperature, 15°.8; greatest daily range of temperature, 32°, on the 1st and 19th, at Farmingdale, and on the 18th, at Hohenwald; least daily range of temperature, 2°, on the 6th, at Rogersville, and on the 24th, at Beech Grove; mean of maximum temperatures, 98°.0; mean of minimum temperatures, 66°.8.

Average number of clear days, 11.3; average number of fair days, 11.5; average number of cloudy days, 8.2; average number of days on which rain fell, 11.5.

Mean depth of rainfall, 3.32 inches; mean daily rainfall, 0.107 inch; greatest rainfall, 5.67 inches at Grief; least rainfall, 0.80 inch, at Woodstock; greatest local daily rainfall, 2.13 inches, on the 24th, at Florence Station.

Days of greatest rainfall, 4th, 5th, 6th, 7th, 21st, 24th; day of greatest rainfall, 24th; day without rainfall, 15th.

Warmest days, 19th, 30th, 31st; coldest day, 1st.

Prevailing winds, south and southwest.

NOTES AND EXTRACTS.

COINCIDENCE OF SUN SPOTS WITH THUNDER-STORMS AND AURORAS.

The following extract is published in view of the general interest in sunspot investigations:

As the result of the extended series of observations described, it has been found in general that whenever groups of faculae, with or without dark spots, are appearing by rotation or are bursting forth upon the earthward side of the sun there is an immediate increase in thunder-storms in the lower latitudes, and probably of auroras in the higher latitudes. If, however, the aurora becomes visible nearer the equator at such times, there is an immediate, though perhaps temporary, decrease in thunder-storms, as though the aurora had taken their place. In short, the aurora and thunder-storms appear to have a common origin, and in certain localities, at least, a reciprocal relation to each other. Instances have been noted also in which an aurora in the United States has been coincident with unusual electrical storms in Europe, and vice versa.

The relation between the various phenomena is such that if an increase of thunder-storms or auroras is noted, faculae coming into view by rotation or bursting forth elsewhere upon the sun may be looked for with confidence. On the other hand the appearance upon the sun of bright faculae betokens an immediate increase in the electrical phenomena attending the storms which may be prevailing at the time anywhere on the face of the earth, unless an aurora should intervene, as has already been noted.

In general the disturbed solar and terrestrial conditions increase or diminish in like ratio. The curious fact has been noted, however, that a single disturbance occupying the sun's disc alone seems to have a more marked effect than a succession of such disturbance as though variability of tension rather than the maintenance of high tension were most concerned in the production of the phenomena in question. Aside from this, and as a rule, however, there is an evident proportion between the extent of the disturbances on the sun and those on the earth. Neither auroras nor thunder-storms become universal, but are distributed in accordance with laws which it is not proposed to discuss at present. The point is that under known limitations and in definite localities there is an increase in these phenomena whenever the solar conditions are favorable, and no such increase has been noted at any other time.

As is the case with auroras and thunder-storms, the disturbances of earth

currents, known as magnetic storms, are subject to limitations and do not prevail with equal intensity at any one time over the entire surface of the globe.

The forces manifest in thunder-storms and auroras being of the character and having the origin that has been described, the question arises as to whether these forces are concerned also in the production of the movements of the atmosphere with which they are associated. (By M. A. Veeder, in *The Electrical World*, Vol. X. No. 9.)

EFFECT OF RAINFALL UPON TEMPERATURE OF THE AIR.

From Saturday, July 16th, to Sunday, July 24th (both inclusive) there fell 7.3 inches of rain, as measured in a rain-gauge at my residence on the Ridgewood Road, Maplewood, situated about one-third up the slope of the Orange Mountain, and exactly fourteen miles due west from New York City. There are 43,560 square feet on an acre; and 7.3 inches equals 0.608 of a foot; 43,560 x 0.608 equals 26,484 cubic feet to the acre. * * * Now it has been determined by accurate experiments, that if we could put all the heat given out by the burning of twenty pounds of dry white pine into a cubic foot of water, it would convert the water entirely into vapor, having the ordinary temperature (say 60°) of the air.

When vapor condenses into water, the heat which kept it as vapor must evidently go out from it. The data gives us some curious figures. As we had a fall of 26,484 cubic feet to the acre, it would require 20 x 26484, or 529,680 pounds of dry pine wood to send this mass of water again into vapor. A cord of dry white pine is said to weigh 1,868 pounds, and 529,680 divided by 1,868 gives 283 cords as the quantity of pine wood required, in burning, to evaporate our recent rainfall on an acre; and before that rain could fall on the acre, just as much heat as is given out in the burning of 283 cords of pine wood had to be lost to the vapor and given out to the air above us. Should we be surprised that a fall of rain (except it be very cold) rarely cools the air? [A. M. Mayer, in *Scientific American*, No. 6, vol. lvii.]

The above extract will be of interest in connection with the consideration of rainfall as a modifier of high summer temperatures. It should be remembered that the heat liberated by condensation is usually at quite an elevation above the earth surface, and its influence upon the surrounding air will generally cause it to rise instead of falling to the earth. At the same time the stratum of air next to the earth is being charged by vapor produced from the rainfall coming in contact with the heated earth. This evaporation will cause

a large amount of heat to be taken up and will correspondingly reduce the temperature of the earth surface.

NORTH ATLANTIC STORMS DURING 1885.

[By Sergeant E. B. GARRIOTT, Signal Corps.]

It is intended to herein show the characteristics of the storms that appeared over the north Atlantic Ocean during 1885, with particular reference to their direction of movement, rate of progress, and the extent of territory they traversed, as shown by the storm-track charts and accompanying text published with the MONTHLY SUMMARY AND REVIEW OF INTERNATIONAL METEOROLOGY. The causes which contributed to abnormal movements of storm-areas over the ocean will also be considered, as determined by daily charts containing the data of simultaneous, international observations furnished by shipmasters. Before entering upon a discussion of this subject it is pertinent to state that it is a common belief that a large percentage of the storms which leave the American coast travel across the Atlantic and affect the weather conditions of western Europe. In this connection the storm-track charts show that of the sixty storms which advanced over the ocean from the American continent during the year, twenty-eight, or nearly 47 per cent. were traced to European waters. During the same period fifty-nine storms developed, or first appeared, over the ocean, of which about 65 per cent. were traced to the west coast of Europe.

The general direction assumed by storm-areas in the middle latitudes was east-northeast, and the average time occupied in crossing the ocean was four and six-tenths days; these averages holding good for each month of the year, except March, August, and October, when no storms traversed the ocean from coast to coast.

The direction of movement was due principally to the relative positions of the permanent area of high pressure which occupied the ocean south of the fortieth parallel, and the area of low pressure which appeared each month to the northward of the fiftieth parallel, the monthly positions of which, together with the mean barometric pressures as shown by the encircling isobars, being given in the following table:

Month.	Positions of centres of mean high barometer areas.			Positions of centres of mean low barometer areas.		
	Latitude.	Longitude.	Barometric pressure.	Latitude.	Longitude.	Barometric pressure.
1885.						
January	N. 30	W. 55	30.20	N. 60	W. 30	29.50
February	25	55	30.10	60	10	29.40
March	40	30	30.30	70	E. 10	29.60
April	35	30	30.20	55	W. 20	29.70
May	30	35	30.10	60	0	29.80
June	35	30	30.20	65	20	29.80
July	38	25	30.30	65	30	29.80
August	30	40	30.10	65	30	30.00
September	35	30	30.20	65	20	29.60
October	40	25	30.20	60	E. 5	29.70
November	30	40	30.10	55	W. 30	29.60
December	45	0	30.20	70	E. 30	29.40
	30	40	30.10			

This table, in showing the relative positions of mean high and low barometer areas, verifies the fact that areas of low pressure, as a rule, take a north of east course along the west and north margins of high barometer areas, and advance to localities where the barometric pressure is least. It also shows that in March and October, when no storms traversed the ocean, the area of mean high pressure was located over mid-ocean in unusually high latitudes, and that during August the pressure was uniformly high over the entire ocean, and no area of relatively low mean pressure appeared in high latitudes, thus explaining why, in March and October, the storm-areas moved northward before reaching European waters, and in August why, in the absence of a mean low-area in high latitudes and the presence of unusually high average pressure along the middle latitudes, the storm-areas did not move eastward.

The flow of the Gulf Stream also seems to contribute to the normal direction of storms on the Atlantic, and it is found that here, as over other portions of the globe, cyclonic areas are inclined to follow the courses of warm ocean currents. These apparent causes, together with the earth's form and motion, seem to occasion the normal direction of storms over the Atlantic in the vicinity of the trans-Atlantic ship routes.

As regards the rate of progress of storms it may be generally stated that this feature, while depending largely upon the energy possessed by a storm upon leaving the coast seems to depend to a greater extent upon the barometric conditions which exist over the ocean to the eastward. Storm-areas do not pass through high barometer areas, and their forward movement is showed to be barred by areas of high pressure. During the annual movement of the Arctic ice fields over the Banks of Newfoundland the rates of progress as well as the direction of storms in that vicinity are greatly diversified, and while they acquire great energy in that region, a large proportion disperse over mid-ocean. These characteristics may be accounted for by the presence in that locality during the ice season of marked ranges in atmospheric temperature and humidity upon which a storm's strength is dependent, and a comparative absence of these conditions over the ocean to the eastward, whence the storm-areas are apparently forced by high barometer areas advancing from the westward. It would appear, therefore, that a storm's movement,

both as regards speed and direction, depends upon its position relative to high barometer areas; its strength, and its position with reference to the warm ocean currents.

The extent of territory traversed by an ocean storm seems to depend not alone upon the conditions above mentioned, but also upon the region wherein it is first developed. It is shown that storms that originate in sections where the elements of their strength were well defined, exhibit a rapid loss of energy after leaving those regions. This fact may be illustrated by the cyclones peculiar to the West Indies during the summer season, which originate near the limits of the belt of equatorial rain and calm and move westward over the Caribbean Sea along the surface of the warm equatorial current and then circle slowly northward and eastward to colder latitudes, where they gradually lose energy and dissipate. It is noticeable that but an insignificant proportion of the storms which advance from southern latitudes cross the Atlantic in the vicinity, or to the northward, of the trans-Atlantic ship routes, and it is equally observable that, as a rule, the storms which do traverse the ocean leave the coast north of the fortieth parallel.

In summing up the above facts it would appear that a knowledge of the barometric conditions over mid-ocean would be necessary to foresee the probable course of a storm leaving the American coast, and that high pressure, north of the fortieth parallel, would prevent a storm from reaching European waters. The changes in position of the permanent area of high barometer which usually occupies the ocean in the vicinity of the Azores are exceedingly slow, and its change of location to more southern latitudes could not be safely calculated upon following its northward movement. It would also appear that the barometric gradient between the regions of high and low pressure constitutes an important factor in calculating the movement of ocean storms, and that storms move toward the region of permanent low pressure. It is also shown that storms of tropical or sub-tropical origin are not calculated to flourish in middle or northern latitudes, and finally that, with conditions over the ocean favorable to their passage, the storms of marked strength which leave the American continent, north of the fortieth parallel, are the ones most likely to affect the weather conditions of Europe. As only forty-seven per cent. of the storms traced during the year from the American coast crossed the ocean, it will be seen that the disturbances which occur in European waters are more generally due to storms which develop over the ocean, sixty-five per cent. of which were traced to Europe.

MEAN TEMPERATURE FROM MAXIMUM AND MINIMUM THERMOMETERS.

Observations of the temperature, taken at hourly intervals, will no doubt furnish a satisfactory basis upon which to construct a mean temperature for any period. The want of satisfactory registering instruments for recording the temperature for each hour or moment of the day, and the time and expense of making personal hourly observations, makes it impracticable to obtain means at all points from hourly readings. A daily mean, computed from various intermediate observations, has been found satisfactory for purposes of climatology. Of these, a mean of observations made at 7 a. m., 2 p. m., and 9 p. m., or at 7 a. m., 3 p. m., and 11 p. m., have given good results. There are many amateur or voluntary observers who find it inconvenient to even take observations at these hours, and important temperature results from their localities are not available. If such observers can take a single daily reading of registering maximum and minimum thermometers their observation could be used to good advantage for constructing mean temperature. A mean of these two daily readings gives a satisfactory mean temperature for the day. The following table gives a comparison of monthly means obtained at a number of stations from observations taken during the year 1885, at 3 a. m., 7 a. m., 11 a. m., 3 p. m., 7 p. m., and 11 p. m., and means of the daily maximum and minimum temperature. An examination of the table will show that the difference between the two means is scarcely appreciable, with a few exceptions. The discrepancy in annual means for three of the five stations given, viz.: Boston, Buffalo, and Washington is only .03; for Cincinnati it is .04; and Chicago, .05; the mean of the maximum and minimum temperatures being higher at all stations.

Month.	Boston.		Buffalo.		Chicago.		Cincinnati.		Washington.	
	Mean of six observations.	Mean of daily maxima and minima.	Mean of six observations.	Mean of daily maxima and minima.	Mean of six observations.	Mean of daily maxima and minima.	Mean of six observations.	Mean of daily maxima and minima.	Mean of six observations.	Mean of daily maxima and minima.
January	27.2	27.4	20.5	21.0	18.2	18.6	25.9	26.0	33.1	33.7
February	20.5	20.6	13.0	14.6	16.8	17.8	23.2	23.4	26.7	27.0
March	27.9	27.6	19.9	20.4	30.1	31.3	33.4	34.8	34.0	34.8
April	46.7	47.4	39.0	40.7	45.5	46.3	53.0	53.6	53.5	53.6
May	52.4	53.2	53.1	53.8	53.2	53.4	62.2	62.0	62.4	62.4
June	66.6	66.7	61.5	60.8	65.6	65.4	70.2	70.4	71.3	71.3
July	71.4	71.8	70.5	70.0	73.1	73.2	78.0	78.0	78.0	78.4
August	67.4	67.8	65.5	65.0	68.4	68.4	73.7	73.7	73.5	73.9
September	59.9	60.2	61.0	60.2	64.2	64.4	66.0	66.4	66.4	66.6
October	51.4	51.6	49.9	50.0	51.3	51.6	52.6	53.0	55.0	55.4
November	43.7	44.0	40.7	41.1	42.0	42.7	43.7	44.2	45.5	45.4
December	32.8	32.6	30.1	31.1	31.8	31.8	34.9	35.3	37.4	38.1
Annual mean	47.3	47.6	43.8	44.1	46.6	47.1	51.3	51.7	53.1	53.4

Stations and districts.	Elevation above level, feet.	Atmospheric pressure (in inches and hundredths).				Temperature of the air (in degrees Fahrenheit).												Winds.																											
		Mean actual barometer.	Departure from normal.	Mean reduced barometer.	Extremes.			Monthly mean.	Departure from normal.	Extremes.			Monthly range.	Daily ranges.	Mean relative humidity, per cent.	Mean temperature of the dew-point (in degrees Fahrenheit).	Precipitation (in inches).	Departure from normal precipitation (in inches).	Total movement, miles.	Prevailing direction.	Maximum velocity.	Miles p. h.	Direction.	Date.	No. of rainy days.	No. of cloudy days.	No. of fair days.																		
					Highest barometer.	Lowest barometer.	Monthly range of barometer.			Max.	Min.	Date.																Mean min.	Date.	Greatest.	Least.	Date.	Date.	Date.	Date.	Date.	Date.	Date.	Date.	Date.	Date.	Date.	Date.	Date.	Date.
<i>New England.</i>																																													
Boston	53	29.89	+0.06	29.95	30.30	29.62	7.0.58	70.9	+2.1	83.8	3	68.7	49.0	10	53.1	34.8	26.6	7	6.4	22	88.2	57.0	4.94	-0.06	5.317	s.	31	e.	10	13	2	16	3												
Portland	99	29.84	+0.05	29.94	30.18	29.55	10.0.03	70.1	+1.1	95.8	2	77.0	56.7	20	63.2	39.1	25.6	13	4.4	22	79.9	62.7	4.70	+0.88	5.550	s.	31	e.	6	12	4	18	9												
Manchester	99	29.70	.....	.....	.....	.....	.....	73.2	+2.3	93.8	2	82.8	55.6	21	63.9	37.7	28.6	1	5.1	18	77.4	64.8	7.14	.....	5.562	s.	34	n.w.	3	16	10	16	9						
Mount Washington	6,279	23.93	.....	29.94	30.18	29.53	9.0.05	51.3	.....	66.0	4	58.1	30.4	14	48.0	35.6	21.3	14	3.8	25	90.4	50.1	15.16	+4.53	19.430	w.	84	n.w.	15	22	23	23	3										
Northfield	871	29.93	.....	29.94	30.13	29.55	10.0.58	70.4	+1.4	91.3	2	80.1	54.0	16	60.9	37.3	30.3	2	4.4	25	91.4	63.7	5.33	.....	5.438	s.	36	n.	28	18	8	13	10										
Boston	124	29.84	+0.04	29.95	30.20	29.54	10.0.06	73.4	+3.4	95.1	2	82.0	60.7	10	67.1	34.4	25.7	13	6.5	18	77.0	65.0	3.59	-0.05	7.051	s.	29	n.	29	11	10	14	1												
Edgartown	.....	.....	.....	.....	.....	.....	.....	74.8	.....	87.8	15	80.9	74.1	7	68.6	13.7	.....	.....	.....	.....	.....	.....	2.96	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....		
Nantucket	14	29.99	.....	29.99	30.24	29.60	10.0.04	70.2	.....	83.9	13	76.1	58.1	21	64.7	25.8	17.3	13	6.4	14	85.9	63.4	2.10	.....	6.512	sw.	23	sw.	6	5	3	18	10									
Wood's Hole	22	29.90	.....	29.91	30.27	29.56	10.0.06	70.6	.....	82.5	13	75.2	58.7	21	65.9	23.8	18.4	13	6.4	16	90.2	66.4	2.93	.....	8.520	sw.	23	sw.	7	7	8	13	10									
Vineyard Haven	.....	.....	.....	.....	.....	.....	.....	73.2	.....	89.0	13	81.6	61.7	20	64.8	27.3	25.3	13	10.0	31	.....	.....	3.62	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....		
Block Island	27	29.95	+0.04	29.98	30.22	29.58	10.0.04	71.4	+2.4	83.4	30	76.9	59.2	7	66.8	24.2	16.6	13	5.6	9	89.8	68.1	7.52	+4.55	8.501	sw.	30</																		

Table of miscellaneous meteorological data for July, 1887—Signal Service observations—Continued.

Stations and districts.	Elevation above sea-level, feet.	Atmospheric pressure (in inches and hundredths).				Temperature of the air (in degrees Fahrenheit).										Mean relative humidity, per cent.	Mean temperature of the dew-point (degrees Fahrenheit).	Precipitation (in inches).	Departure from normal precipitation (in inches).	Winds.				Total movement, miles.	Prevailing direction.	Maximum velocity.		Date.	No. of rainy days.	No. of cloudy days.	No. of fair days.	No. of clear days.		
		Mean actual barometer.	Departure from normal.	Mean reduced barometer.	Extremes.		Monthly mean.	Departure from normal.	Extremes.		Monthly range.	Daily ranges.	Greatest.	Least.	Date.					Mean min.	Monthly range.	Date.	Mean max.			Min.	Date.						Miles p. h.	Direction.
					Highest barometer.	Lowest barometer.			Max.	Min.																								
Upper Miss. Valley.																																		
Saint Paul.....	831	29.05	-.01	29.93	30.13	13	29.67	3.0.46	74.1	3.5	93.9	15	85.0	51.3	23	63.0	42.6	29.3	19	11.8	17	70.7	62.9	3.89	1.69	2.256	sw.	30	w.	37	10	5	19	7
La Crosse.....	744	29.19	+.03	29.97	30.17	25	29.70	1.0.47	74.8	2.8	98.4	16	85.9	48.7	23	64.8	49.7	31.2	31	10.4	22	70.0	63.0	1.77	3.27	4.928	sw.	30	s.	29	10	5	18	6
Davenport.....	615	29.31	+.03	29.94	30.13	25	29.74	1.0.38	75.0	4.0	99.0	13	88.7	36.1	24	67.2	42.9	31.0	36	11.0	3	60.5	61.6	3.09	0.48	4.606	sw.	35	nw.	17	11	6	8	17
Des Moines.....	866	29.06	-.09	29.93	30.13	25	29.73	1.0.38	77.5	3.5	101.7	29	89.7	32.0	23	65.6	49.7	34.0	11	11.8	3	61.6	61.5	1.94	1.01	3.264	sw.	39	ne.	12	9	1	16	14
Dubuque.....	665	29.27	+.00	29.90	30.15	24	29.72	3.0.43	78.2	3.5	100.6	16	88.3	34.6	23	67.2	46.0	30.5	29	9.6	20	64.2	63.7	2.44	2.62	2.790	sw.	18	w.	3	8	4	13	14
Keokuk.....	618	29.31	+.02	29.95	30.11	25	29.79	3.0.32	79.1	2.1	100.0	17	90.7	39.9	23	69.1	40.1	28.9	28	11.0	3	60.1	62.4	1.57	2.70	4.721	sw.	36	s.	13	8	2	10	19
Cairo.....	339	29.62	+.08	29.98	30.13	26	29.82	2.0.31	80.5	1.5	97.5	30	89.3	66.2	24	71.9	31.3	22.9	12	10.8	3	67.1	69.3	1.42	2.43	3.888	sw.	27	w.	32	8	3	13	15
Springfield.....	644	29.31	+.02	29.97	30.13	25	29.81	3.0.32	79.7	3.7	99.7	29	91.6	57.8	24	68.2	41.9	30.1	12	14.0	3	69.8	68.3	1.01	1.22	4.535	sw.	24	s.	1	9	5	11	17
Saint Louis.....	571	29.38	+.08	29.96	30.08	13	29.81	3.0.27	83.7	5.7	100.0	17	92.1	68.0	24	75.4	32.0	26.2	7	9.0	2	57.1	65.9	2.73	1.19	4.488	sw.	20	s.	3	6	5	10	18
Missouri Valley.																																		
Lamar.....	1,028	28.94	.....	29.99	30.13	13	29.84	2.0.28	75.3	1.6	99.0	30	89.2	59.6	23	67.5	39.4	27.7	25	9.9	1	67.6	65.2	3.71	0.31	4.784	sw.	28	sw.	6	6	1	10	20
Leavenworth.....	842	29.10	-.01	29.96	30.10	25	29.82	2.0.28	77.9	2.2	101.7	17	91.8	57.3	23	68.0	44.4	32.6	19	11.8	1	64.8	65.0	1.36	3.44	3.729	sw.	24	nw.	31	5	1	14	16
Topeka.....	1,113	28.84	+.01	29.99	30.15	18	29.80	2.0.35	76.5	0.3	104.0	17	94.4	53.0	25	64.3	51.0	44.7	19	19.3	9	60.5	64.4	1.06	3.81	5.065	sw.	25	sw.	12	7	0	14	17
Omaha.....	1,113	28.84	+.01	29.99	30.15	18	29.80	2.0.35	76.5	0.3	103.3	29	87.2	55.1	23	66.4	38.2	31.5	29	11.5	1	62.0	62.0	2.02	3.81	5.065	sw.	25	sw.	12	7	0	14	17
Valentine.....	2,614	27.30	.....	29.94	30.21	18	29.63	10.0.42	72.3	0.7	94.0	14	84.9	53.0	30	50.7	41.6	55.0	13	13.0	7	76.0	55.3	2.53	0.49	7.570	sw.	70	nw.	25	15	3	13	15
Fort Sully.....	1,600	28.25	.....	29.91	30.13	22	29.58	14.0.55	74.8	5.8	103.7	14	88.2	52.6	22	62.4	51.1	35.5	30	13.4	2	60.4	57.8	3.04	0.54	7.175	sw.	47	s.	29	11	4	17	10
Huron.....	1,307	28.57	.....	29.94	30.16	18	29.66	10.0.50	72.0	2.0	99.2	14	84.5	44.3	23	59.4	54.9	38.5	23	8.6	3	65.3	57.9	4.96	0.64	7.269	sw.	66	sw.	25	12	4	15	12
Yankton.....	1,234	28.64	-.03	29.93	30.15	18	29.73	15.0.42	74.4	1.4	98.3	15	86.0	52.7	23	63.6	45.6	32.4	19	10.4	17	73.0	64.0	5.00	1.26	4.775	sw.	54	nw.	37	14	1	20	10
Northern slope.																																		
Fort Assinaboine.....	2,590	27.20	+.04	29.98	30.20	21	29.69	9.0.51	68.0	0.4	93.1	6	81.7	42.9	12	53.1	50.2	38.7	17	14.2	26	53.2	48.9	1.16	1.63	6.653	sw.	41	e.	13	5	3	9	19
Fort Custer.....	3,400	26.87	+.05	29.95	30.17	27	29.66	9.0.51	71.4	0.4	97.6	9	84.9	43.9	27	55.3	53.7	41.1	30	18.5	15	48.8	47.4	0.67	0.54	5.076	sw.	48	nw.	1	9	3	18	10
Fort Maginnis.....	4,320	25.65	+.05	29.92	30.17	21	29.74	9.0.43	64.8	2.3	91.3	6	76.6	44.4	27	52.8	48.9	38.4	17	10.4	26	57.1	47.8	2.41	1.87	6.670	sw.	42	nw.	14	11	2	16	13
Helena.....	4,069	25.90	+.03	29.92	30.18	21	29.69	13.0.43	66.6	0.4	91.5	6	79.2	43.5	16	52.8	48.9	34.0	17	10.7	25	54.4	47.8	0.37	0.94	5.290	sw.	36	nw.	17	3	1	12	18
Poplar River.....	2,002	27.86	.....	29.94	30.16	17	29.65	9.0.51	67.6	0.4	97.4	7	81.0	41.9	11	53.1	55.3	44.3	27	9.2	2	69.0	55.6	2.10	0.47	4.879	sw.	36	w.	8	10	1	21	9
Deadwood.....	4,600	25.47	+.04	29.92	30.23	17	29.71	13.0.54	65.8	2.2	98.8	13	76.5	45.0	30	55.4	44.8	33.0	30	7.4	15	54.9	56.2	3.70	1.34	3.439	sw.	32	w.	25	13	6	16	9
Cheyenne.....	6,105	24.14	+.01	29.96	30.23	17	29.73	13.0.50	65.2	0.8	99.5	28	80.5	46.0	3	52.2	43.5	41.3	28	7.3	16	54.6	44.8	2.71	1.05	6.359	sw.	52	n.	21	12	2	21	8
Fort Laramie.....	5,710	24.14	+.01	29.96	30.23	17	29.73	13.0.50	65.2	0.8	99.5	28	80.5	46.0	3	52.2	43.5	41.3	28	7.3	16	54.6	44.8	2.71	1.05	6.359	sw.	52	n.	21	12	2	21	8
North Platte.....	2,841	27.10	.....	29.96	30.23	18	29.72	14.0.51	74.0	1.0	99.4	14	87.7	53.8	22	62.2	45.6	35.8	9	13.5	16	67.9	61.5	3.05	0.27	7.103	sw.	48	e.	23	7	0	19	12
Middle slope.																																		
Denver.....	5,294	24.85	+.03	29.94	30.22	17	29.67	14.0.55	69.0	1.0	92.1	6	82.8	50.0	4	56.6	42.1	38.5	5	9.5	16	52.8	48.1	1.54	1.71	5.038	sw.	36	w.	10	9	4	17	10
Pike's Peak.....	14,134	18.09	.....	29.98	30.18	20	29.78	14.0.50	69.1	0.4	94.8	29	86.5	46.5	3	61.8	26.2	18.6	29	5.1	16	69.3	50.8	6.52	1.23	10.204	sw.	54	w.	29	24	1	26	4
Las Animas.....	3,892	26.08	+.02	29.90	30.15	18	29.65	14.0.50	75.4	0.6	99.5	25	91.2	55.1	4	61.6	44.4	38.2	24	15.7	30	51.6	53.1	1.09	1.21	5.066	sw.	48	nw.	8	9	2	18	11
Concordia.....	1,384	28.53	.....	29.95	30.16	18	29.65	10.0.41	77.7	0.7	102.4	29	90.8	52.7	23	65.8	45.2	33.6	24	14.4	17	59.0	60.0	2.36	1.84	4.951	sw.	38	e.	2	10	3	14	14
Dodge City.....	2,523	27.42	+.02	29.97	30.21	18	29.80	11.0.41	77.7	0.7	102.4	29	90.8	52.7	23	65.8	45.2	33.6	24	14.4	17	59.0	60.0	2.36	1.84	4.951	sw.	38	e.	2	10	3	14	14
Fort Reno.....	2,700	27.27	+.05	29.90	30.08	18	29.71	2.0.37	79.6	3.6	98.7	21	93.8	59.6	24	66.1	39.1	34.6	21	19.9	4	59.5	62.8	0.92	1.98	7.151	sw.	37	s.	19	7	1	12	18
Fort Supply.....	2,700	27.27	+.05	29.90	30.08	18	29.71	2.0.37	79.6	3.6	98.7	21	93.8	59.6	24	66.1	39.1	34.6	21	19.9	4	59.5	62.8	0.92	1.98	7.151	sw.	37	s.	19	7	1	12	18
Fort Elliott.....	2,700	27.27	+.05	29.90	30.08	18	29.71	2.0.37	79.6	3.6	98.7	21	93.8	59.6	24	66.1	39.1	34.6	21	19.9	4	59.5	62.8	0.92	1.98	7.151	sw.	37	s.	19	7	1	12	18
Southern slope.																																		
Fort Sill.....	1,200	28.76	+.01	29.96	30.10	18	29.79	2.0.31	81.0	1.0	105.2	20	97.7	66.2	24	71.7	39.0	32.0	20	14.7	2	57.6	64.6	2.93	0.12	5.771	sw.	36	sw.	14	8	0	10	21
Abilene.....	1,748	28.20	.....	29.93	30.10	18	29.79	2.0.31	83.9	2.9	101.3	20	95.5	64.9	30	73.4	30.4	32.3	24	14.9	29	53.2	63.2	2.71	1.23	7.748	sw.	41	sw.	24	6	2	14	15
Fort Davis.....	4,928	25.26	+.01	29.95	30.11	18	29.79	2.0.32	75.4	0.4	94.2	25	87.1	57.2	16	65.0	37.0	28.3	8	14.8	6	64.7	49.7	3.74	0.42	4.189	sw.	30	nw.	17	4	5	9	17
Fort Stanton.....	6,150	24.09	.....	29.96	30.06	21	29.72	2.0.34	68.6	0.8	91.0	24	82.3	47.2	24	53.3	43.8	43.8	24	12.7	18	67.7	53.0	2.39	0.86	3.062	sw.	30	n.	11	12	4	14	13

Meteorological record of voluntary observers and Army post surgeons, July, 1887.

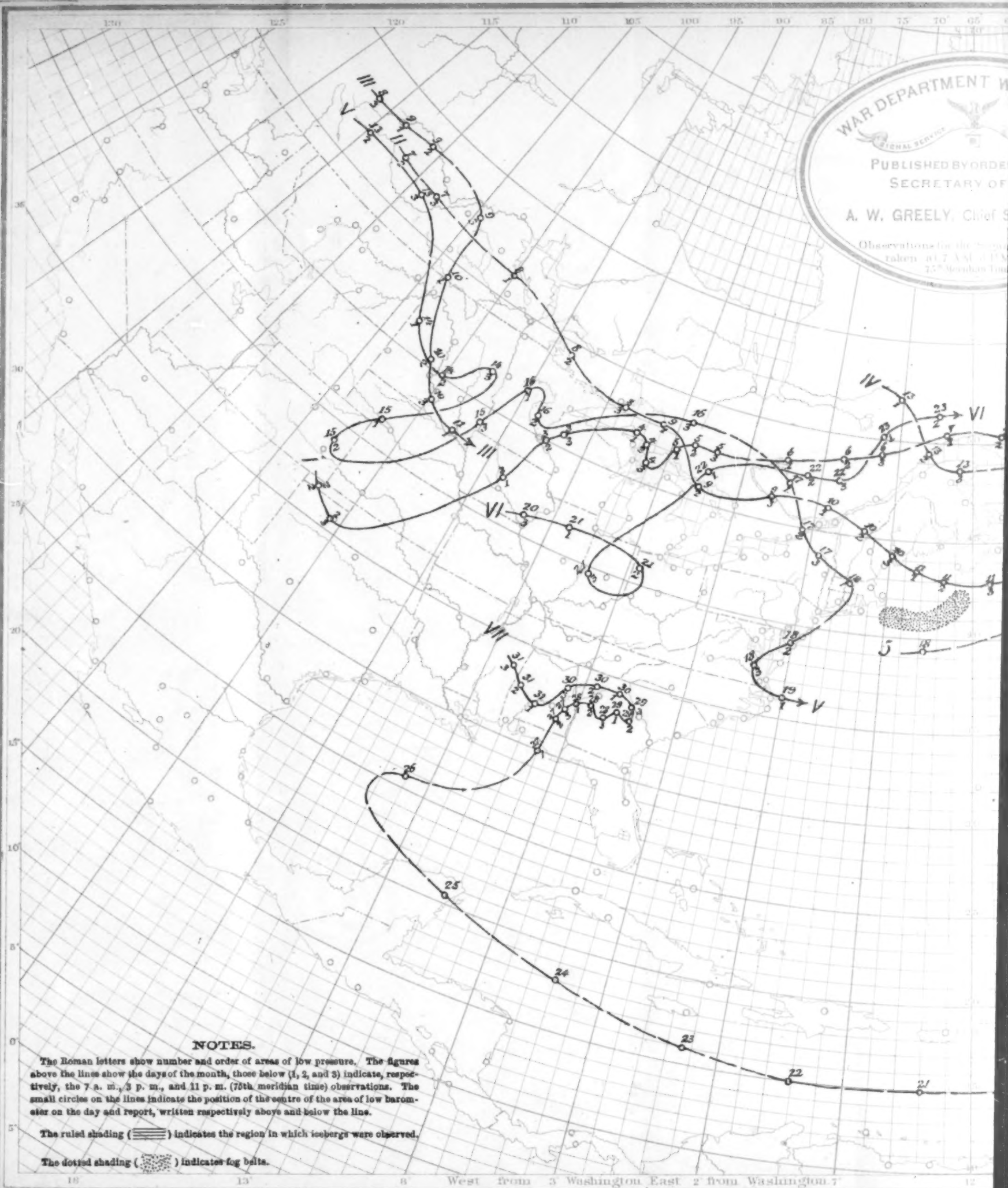
The maximum and minimum temperatures at stations marked thus (*) are from readings of other than standard instruments.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	Stations.	Temperature. (Fahrenheit.)			Precipitation.
	Maximum.	Minimum.	Mean.			Maximum.	Minimum.	Mean.	
<i>Alabama.</i>				<i>Inches</i>	<i>Indiana—Con.</i>				<i>Inches</i>
Greensborough.....	96	72	81.0	3.09	Maury.....	101	53	77.1	0.69
Mount Vernon Bks.....	100	67	81.6	0.01	Sunman*.....	102	62	81.9	2.03
<i>Arizona.</i>					Vevay.....	105	61	81.1	2.21
Hinachuca.....	99	68	80.5	4.06	<i>Indian Territory.</i>				
McDowell, Fort.....	110	60	82.6	0.06	Gibson, Fort.....	109	62	83.4	0.26
Mojave, Fort.....	119	61	82.7	0.25	Reno, Fort.....	105	47	84.9	1.10
Tucson.....				5.08	Supply, Fort.....	101	61	82.4	1.06
<i>Arkansas.</i>					<i>Iowa.</i>				
Hot Springs.....	99	67	80.5	3.70	Bancroft.....	95	46	73.7	2.22
Lead Hill.....	109	57	82.8	1.82	Cresco.....	98	55	77.1	3.11
<i>California.</i>					Cedar Rapids.....	99	51	77.8	4.58
Alcatraz Island.....	64	48	53.8	0.00	Clinton.....	104	49	76.5	2.95
Benicia Barracks.....	91	53	64.8	0.00	Des Moines.....	100	52	76.0	
Bidwell, Fort.....	98	49	72.1	0.10	Fort Madison.....	100	65		1.20
Cahuenga.....				0.10	Humboldt.....	97	45	77.9	4.23
Mason, Fort.....	98	52	57.5	0.00	Independence*.....	94	62	79.0	4.42
Nicolaus.....	99	58	75.0	0.00	Logan.....	105	50	77.3	2.40
Oroville.....	101	57	87.8	0.00	Monticello*.....	100	52	76.2	4.45
Presidio of San F.....	68	45	56.5	0.00	Muscatine.....	104	52	78.4	2.90
Riverside.....	105	50	76.2	0.00	Oakaloosa a*.....	100	61	81.6	3.15
Sacramento.....	100	48	69.4	0.10	Oakaloosa b*.....	103	64		
Salinas.....	73	43	58.9	0.00	<i>Kansas.</i>				
Willows.....	112	31	80.0	0.00	East Norway.....	104	63	83.0	4.40
<i>Colorado.</i>					Elk Falls.....	108			2.61
Grand Junction.....	100	69	76.3	1.60	Emporia.....	99	58	79.9	2.18
Lewis, Fort.....	86	30	65.9	7.54	Globe.....	102	64	78.2	1.72
<i>Connecticut.</i>					Hays, Fort.....	105	51	79.1	1.08
Hartford.....	95	58	79.2	4.47	Independence.....	105	61	81.0	3.21
North Colebrook.....	88	53	70.9	6.05	Lawrence.....	102	56	79.8	2.14
Southington.....	95	64	76.0	3.95	Manhattan a.....	104	60	79.8	1.11
Veinatown.....	94	61		5.80	Marydale Farm.....	105	52	81.2	0.90
<i>Delaware.</i>					Ninnesch*.....	105	61	81.3	2.66
Abr. Lincoln, Fort.....	96	50	71.8	5.30	Riley, Fort.....	105	53	82.3	2.50
Henry.....	92	49	70.1	3.90	Wilson*.....	103	63	82.6	2.30
Highmore.....	100	48	71.4	4.46	Wellington.....	104	62	81.3	3.45
Meads, Fort.....	100	48	71.4	3.50	West Leavenworth.....	104	60	81.3	4.30
Parkside.....	104	58	74.7	3.90	Wakenet*.....	108	63	81.3	1.58
Randall, Fort.....	103	37	74.7	5.50	<i>Kentucky.</i>				
Slometon, Fort.....	92	41	66.0	5.50	Bowling Green.....	102	72		
Sully, Fort.....	108	53	76.3	2.77	Harper's Ferry*.....	101	78	85.9	2.43
Totten, Fort.....	92	48	67.7	5.39	Frankfort.....	103	57	80.6	3.17
Webster.....	100	48	71.7	4.73	<i>Louisiana.</i>				
Yates, Fort.....	99	38	74.0	2.19	Grand Coteau.....	94	70	81.5	6.63
<i>District of Columbia.</i>					Liberty Hill.....	94	73	85.5	11.15
Distributing reservoir.....	102	70	83.5	3.09	<i>Maine.</i>				
Receiving reservoir.....	100	70	83.3	3.12	Bar Harbor.....	91	50		3.48
Rock Creek bridge.....	104	73	85.7		Cornish.....	92	61	72.7	5.85
<i>Florida.</i>					Gardiner.....	91	54	70.4	6.90
Archer*.....	98	66	75.4	9.72	Orono*.....	93	56	71.0	7.11
Duke.....	100	69	79.7	3.33	<i>Maryland.</i>				
Fort Meade*.....	97	75		0.75	Cumberland.....	98	60	77.7	5.39
Homeland.....	98	73	82.4	4.20	Fallston*.....	97	64	76.7	5.39
Limona*.....	97	73	83.3	12.50	Great Falls.....	103	66	82.4	4.08
Manatee.....	94	74	84.2	10.15	McDonogh.....	95	64	80.1	4.11
Merritt's Island.....	95	72	80.8	3.81	McHenry, Fort.....	89	68	81.3	6.26
St. Augustine, Fort.....	94	70	81.8	2.20	New Midway*.....	104	61	82.4	6.21
Tallahassee.....				12.45	Woodstock.....	98	58	78.0	4.43
Homeland.....	98	73	82.4	4.20	<i>Massachusetts.</i>				
<i>Georgia.</i>					Amherst.....	94	56	73.7	8.93
Athens.....	100	65	78.9	14.47	Blue Hill Obs'y's mt.....	91	57	70.8	5.01
Foreyth*.....	102	73	81.4	12.70	" " (base).....	92	58		4.91
Milledgeville.....	100	70	81.4	16.09	Deerfield.....	92	59	74.8	10.66
<i>Idaho.</i>					Dudley.....	97	48	75.2	10.49
Boise Barracks.....	100	45	77.3	0.12	Fall River.....	89	62	72.1	4.30
Sherman, Fort.....	91	39	66.9	0.90	Heath.....	96	56		
Lewiston*.....	103	61		0.31	Milton.....	95	59	72.5	4.81
<i>Illinois.</i>					New Bedford.....	91	55	71.8	3.58
Collinsville.....	100	64	80.2	1.77	North Truro.....				3.63
Charleston*.....	107	50	80.6	0.36	Somerset.....	99	62	77.5	4.15
Geneseo.....	102	48	79.7	1.95	Taunton.....	94	57	73.3	6.25
Maitson.....	108	62	81.5	1.30	Westborough.....	99	60	76.7	3.71
Pekin.....	104	55	82.0	2.79	Williamstown.....	88	56	72.3	10.82
Pecora*.....	106	59	82.2	2.85	<i>Michigan.</i>				
Riley.....	98	59	75.1	2.70	Birmingham.....	102	49		1.27
Rockford.....	97	58	75.6	3.12	Brady, Fort.....	90	41	69.4	4.18
Sandwich.....	103	60	79.8	4.74	Harrieville*.....	101	39	76.9	4.98
South Evanston.....	103	49		1.34	Hudson.....	97	45		3.10
Sycamore.....	101	40	75.0	3.12	Kalamazoo.....	98	58	77.0	0.79
Windsor.....	106	52	80.8	2.87	Lansing.....	96	45	75.8	1.68
<i>Indiana.</i>					Mottville.....	96	55		1.13
Butlerville.....	106	70	83.6	0.57	Swartz Creek.....	100	41	74.7	2.08
Jeffersonville.....	101	61	82.3	1.39	Thorville*.....	98	51	76.2	1.75
Lacoma.....	105	71	83.0	0.62	Traverse City.....	104	45	71.0	2.70
Logansport*.....	104	57	81.8	2.65					
Lafayette.....	105	53	79.8	0.88					

Meteorological record of voluntary observers, etc.—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	Stations.	Temperature. (Fahrenheit.)			Precipitation.
	Maximum.	Minimum.	Mean.			Maximum.	Minimum.	Mean.	
<i>Minnesota.</i>					<i>Ohio—Continued.</i>				
Minneapolis.....	96	61	74.8	3.49	Wauseon.....	101	47	77.1	2.87
Snelling, Fort.....	95	48	75.1	3.10	Yellow Springs.....	99	58	77.8	1.00
<i>Montana.</i>					<i>Oregon.</i>				
Keogh, Fort.....	103	40	74.2	0.44	Albany*.....	92	54	66.9	0.00
Missoula, Fort.....	88	46	67.5	0.69	Bandon*.....	96	38	54.6	0.15
Shaw, Fort.....	96	39	68.5		East Portland*.....	92	40		
<i>Nebraska.</i>					<i>Eola*.....</i>				
Brownville*.....	106	59	83.4	2.30	Klamath, Fort.....	94	25	64.7	0.00
Crete.....	103	53	76.2	1.75	La Grande.....	98	41		0.33
De Soto*.....	105	51	76.5	1.17	Mount Angel.....	93	31	67.7	0.00
Fremont.....	101	59	73.9	3.83	<i>Pennsylvania.</i>				
Genoa.....	98	55	75.7	4.38	Altoona.....	102	61	81.0	3.13
Hay Springs.....	99	47	70.7	1.48	Bethlehem.....	100	68	79.2	8.58
Marquette.....	99	47	70.7	1.59	Bloomington*.....	98	64	75.6	10.90
Niobrara, Fort.....	101	50	76.6	1.66	Catawissa.....	96	55		1.70
Robinson, Fort.....	99	60	71.2	1.90	Corry.....	97	42	73.7	2.76
Sidney, Fort.....	103	50	72.7	1.53	Fallsington*.....	94	67	70.2	9.38
Tecumseh*.....	103	55	80.3	0.80	Dyberry.....	93	50	72.6	9.28
<i>Nevada.</i>					Franklin*.....	96	56	73.0	1.66
Carson City.....	98	40	71.5	0.23	Drifton.....	98	53	74.0	5.90
McDermitt, Fort.....	96	43	73.4	0.40	Easton.....	95	68		11.28
<i>New Hampshire.</i>					Germantown.....	96	68		10.84
Antrim.....				6.10	Grampian Hill.....	100	62	76	3.55
Ashland.....				4.80	Quakerstown*.....	90	60	70.8	9.25
Belmont.....				5.63	State College.....	97	55	76.2	4.68
Berlin Mills.....	100	53		7.28	Wellsborough*.....	96	56	74.7	7.03
Bristol.....				6.08	West Chester.....	96	64	77.1	11.27
Concord.....	95	56	74.2	7.52	Wilkesbarre.....	99	58	75.3	8.76
Lake Village.....				6.83	<i>South Carolina.</i>				
Nashua.....	97	55	73.7	7.95	Kirkwood.....	95	72	81.6	4.13
Wier's Bridge.....				5.48	Spartanburg.....	107	60	88.8	6.66
Wolfeborough.....				6.90	Stateburg.....	103	67	79.3	4.90
Woodstock.....				6.70	<i>Tennessee.</i>				
<i>New Jersey.</i>					Ashwood.....	97	70	83.5	3.34
Beverly.....	97	69	78.1	9.48	Austin*.....	101	74	83.7	2.33
Clayton*.....	102	63	79.6	4.57	Milan.....	101	68	86.7	2.39
Dover.....	96	55	73.0	10.02	<i>Texas.</i>				
Egg Harbor City.....	100	58	77.2	4.59	Austin*.....	104	71	87.4	0.00
Moorestown.....	98	68	76.8	6.39	Cleburne.....	98	70	80.0	3.17
Readington.....	98	72	79.6		Comfort.....	100	68		0.14
Roseland.....	94	55		9.17	Concho, Fort.....	106	68	86.5	0.93
Salem.....	102	68	79.0		Corsicana.....				1.60
South Orange.....	90	62	73.4	9.38	McIntosh, Fort.....	103	70	88.5	1.00
<i>New Mexico.</i>					Midland.....	103	71	84.1	1.07
Bayard, Fort.....	95	59	75.9	1.57	New Uim.....	98	67	83.3	2.76
Galinas Spring.....	92	66		0.42	Ringgold, Fort.....	104	67	85.0	
Galinas, Fort.....	108	58	81.7	0.68	Silver Falls.....	101	63		1.89
Union, Fort.....	92	47	72.7	2.83	<i>Vermont.</i>				
Wingate, Fort.....	89	50	68.0	2.94	Burlington*.....	92	60		2.22
<i>New York.</i>					Charlotte.....	94	60	74.2	3.10
Auburn.....	92	59	73.9	6.97	Lunenburg.....	88	58	74.2	4.86
Brooklyn a.....	96	64		7.47	Newport.....	92	60	73.7	6.15
Brooklyn b.....	93	66	75.8	7.47	Straford*.....	90	56	73.5	5.60
Columbus, Fort.....	95	65	76.8	8.36	<i>Virginia.</i>				
Cooperstown*.....	90	61	73.0	2.85	Bird's Nest*.....	102	75	84.0	5.60
Factoryville*.....	90	55	74.5	7.19	Bringington.....	98	76		3.19
Humphrey.....	95	60	75.3	3.53	Dale Enterprise*.....	104	64	83.0	7.00
Ithaca.....	95	56	74.8	3.97	Monroe, Fort.....	99	69	81.8	3.90
Madison Barracks.....	94	66	78.2	0.53	Marion.....	90	61	76.0	1.75
Menands.....	90	65	75.7	4.83	Summit.....	100	57	79.3	
Niagara, Fort.....	95	60	75.6	0.83	University of Va.....	90	60	74.9	3.37
Palermo*.....	95	57	72.6	2.65	Variety Mills.....	101	56	77.5	5.15
Palmyra*.....	98	64	77.3		Weytheville.....	94	53	75.5	5.58
Penn Yan.....				4.00	<i>Washington Territory.</i>				
Plattsburg Barracks.....	90	58	73.2	2.03	Blakely*.....	88	43	62.0	0.10
Setauket.....	90	52	71.8	5.30	Kenewick*.....	105	44		0.00
Utica.....	103	40	71.8		Tacoma.....	80	51	61.4	0.14
West Point.....	93	57	75.6	7.44	Townsend, Fort.....	82	43	61.0	0.12
White Plains.....	88	69	76.9	0.91	Spokane, Fort.....	101	40	70.0	0.10
<i>North Carolina.</i>					Vashon.....	80	47	60.3	0.10
Hot Springs.....	91	60	75.8		Walla Walla, Fort.....	102	45	79.0	0.03
Lenoir.....	95	48		5.70	<i>West Virginia.</i>				
Reidsville.....	103	38	70.9	4.76	Clarkburg.....	94	55	80.0	1.29
Roanoke.....	101	73	82.0	9.30	Helvetia*.....	94	50	73.8	2.86
Statesville*.....	99	70	79.1	0.54	Middlebrook.....	86	55	70.0	
Wake Forest.....	102	64	80.8	8.34	Parkersburg.....	100	62	84.6	2.40
Weldon.....	103	69	80.8	6.27	<i>Wisconsin.</i>				
<i>Ohio.</i>					Beloit.....	99	47	75.9	1.61
Cleveland.....	96	63	75.9	1.71	Delavan.....	98	48	74.7	3.83
College Hill*.....	105	60	80.0	1.50	Embarras.....	94	54	74.3	4.40
Elyria.....	100	55		0.79	Fond du Lac.....	100	43	74.3	3.90
Garrettsville.....	99	50	72.7	1.27	Franklin.....	101	64	76.0	
Jacksonborough*.....	102	66	80.2	0.70	Lancaster.....	102	48	61.8	3.92
Napoleon.....	100	52	80.4	1.35	Madison.....	94	56	74.7	5.49
North Lewisburg.....	102	58	81.1	2.30	Prairie du Chien.....	95	59	76.9	4.15
Portsmouth.....	101	59	78.0	4.12	<i>Wyoming.</i>				
Ruggles*.....	99	52	75.0	0.70	Camp Sheridan.....	93	30	61.1	
Tiffin a*.....	102	62	77.7	1.27	Laramie, Fort.....	101	50	73.8	1.99
Tiffin b*.....	102	66	70.7	1.46	Washakie, Fort.....	101	40	72.0	0.80
West Milton*.....	108	62	85.0	1.88					

WAR DEPARTMENT
SIGNAL SERVICE
PUBLISHED BY ORDER
SECRETARY OF
A. W. GREELY, Chief S
Observations for the year
taken at 7 A.M. and 3 P.M.
75° Western Time



NOTES.

The Roman letters show number and order of areas of low pressure. The figures above the lines show the days of the month, those below (1, 2, and 3) indicate, respectively, the 7 a. m., 3 p. m., and 11 p. m. (75th meridian time) observations. The small circles on the lines indicate the position of the centre of the area of low barometer on the day and report, written respectively above and below the line.

The ruled shading (▨) indicates the region in which icebergs were observed.

The dotted shading (⋯) indicates fog belts.

Low Pressure. July, 1887.

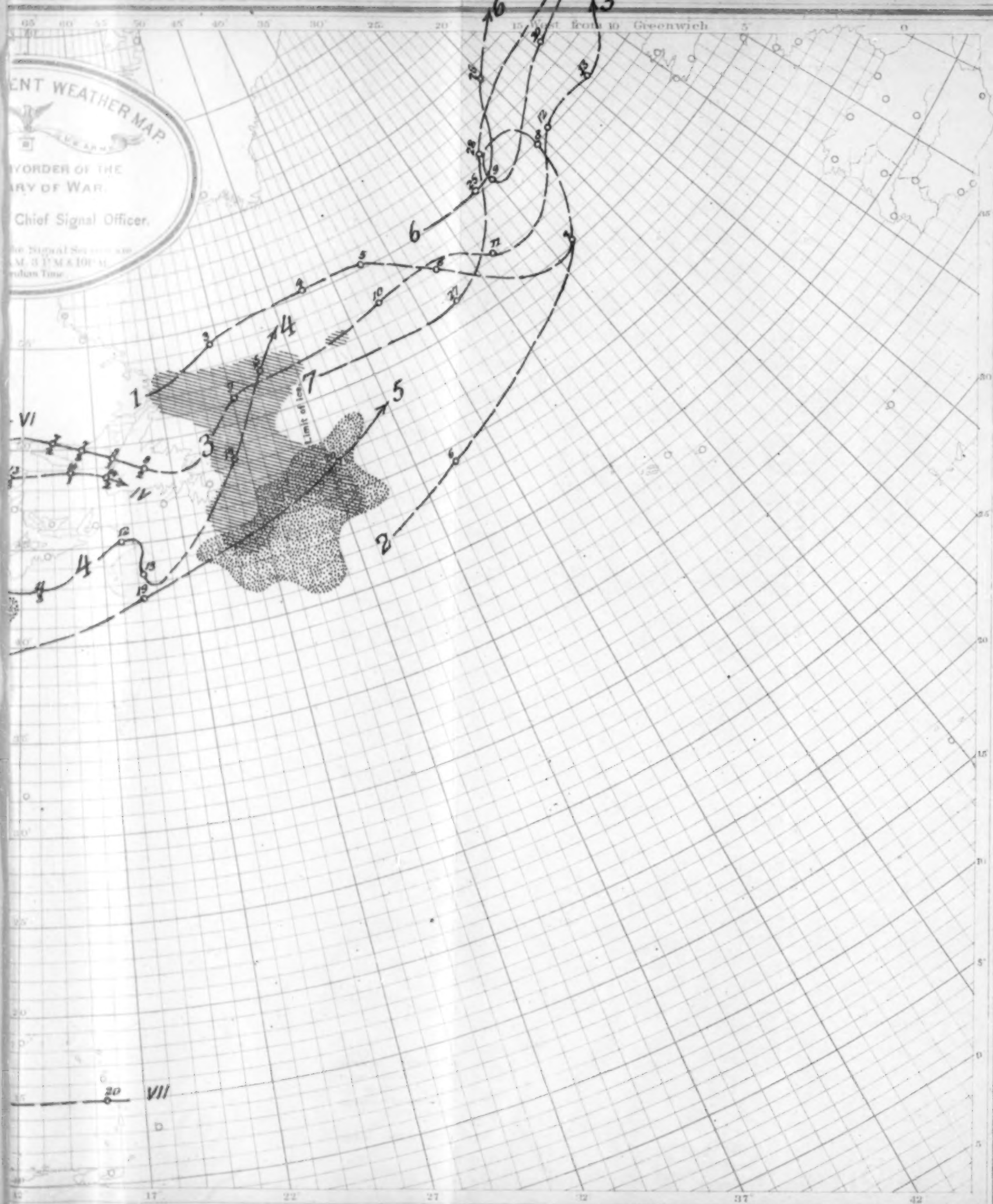




Chart II. Isobars, Isotherms, and Winds, July, 1887.

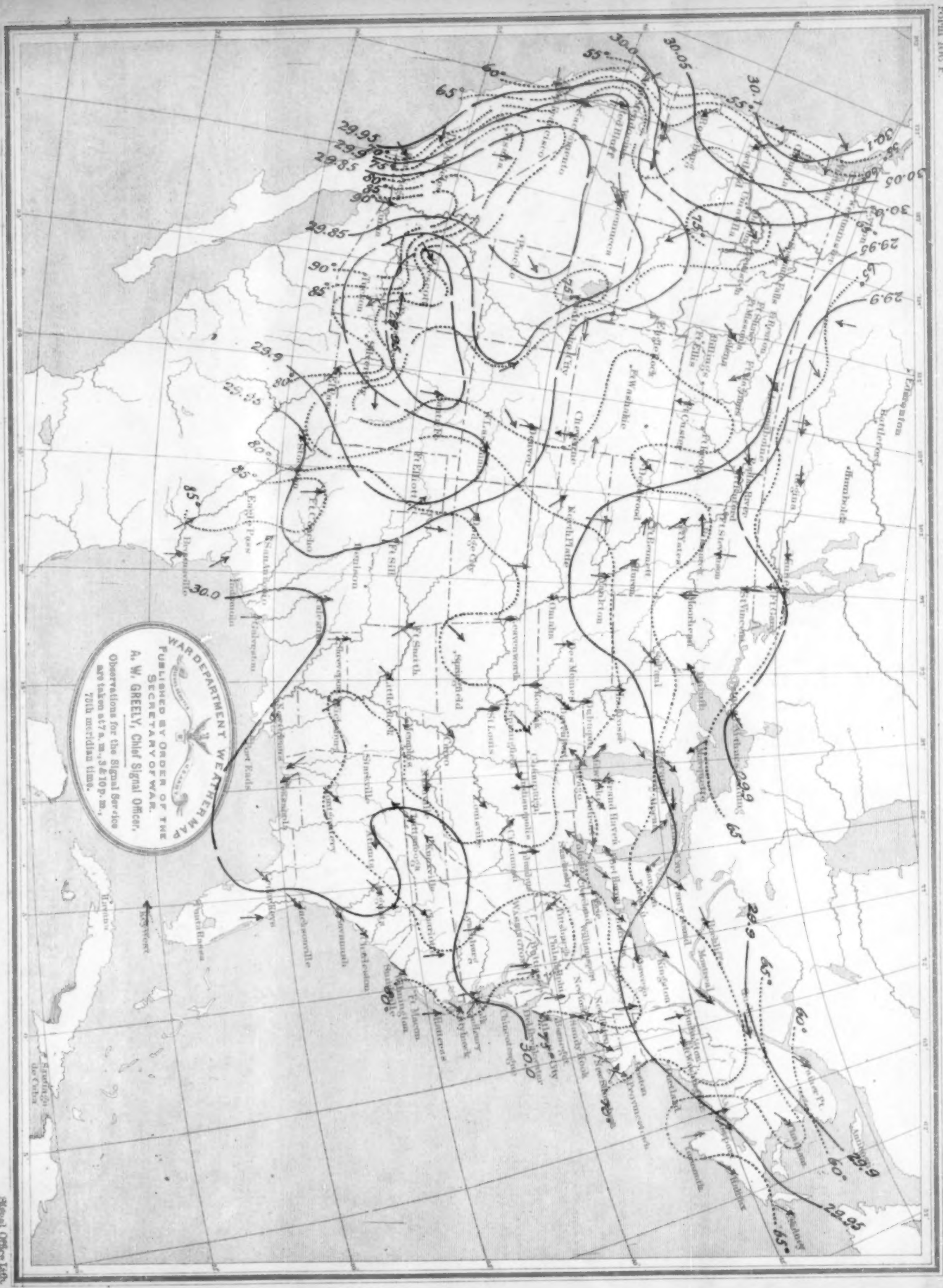
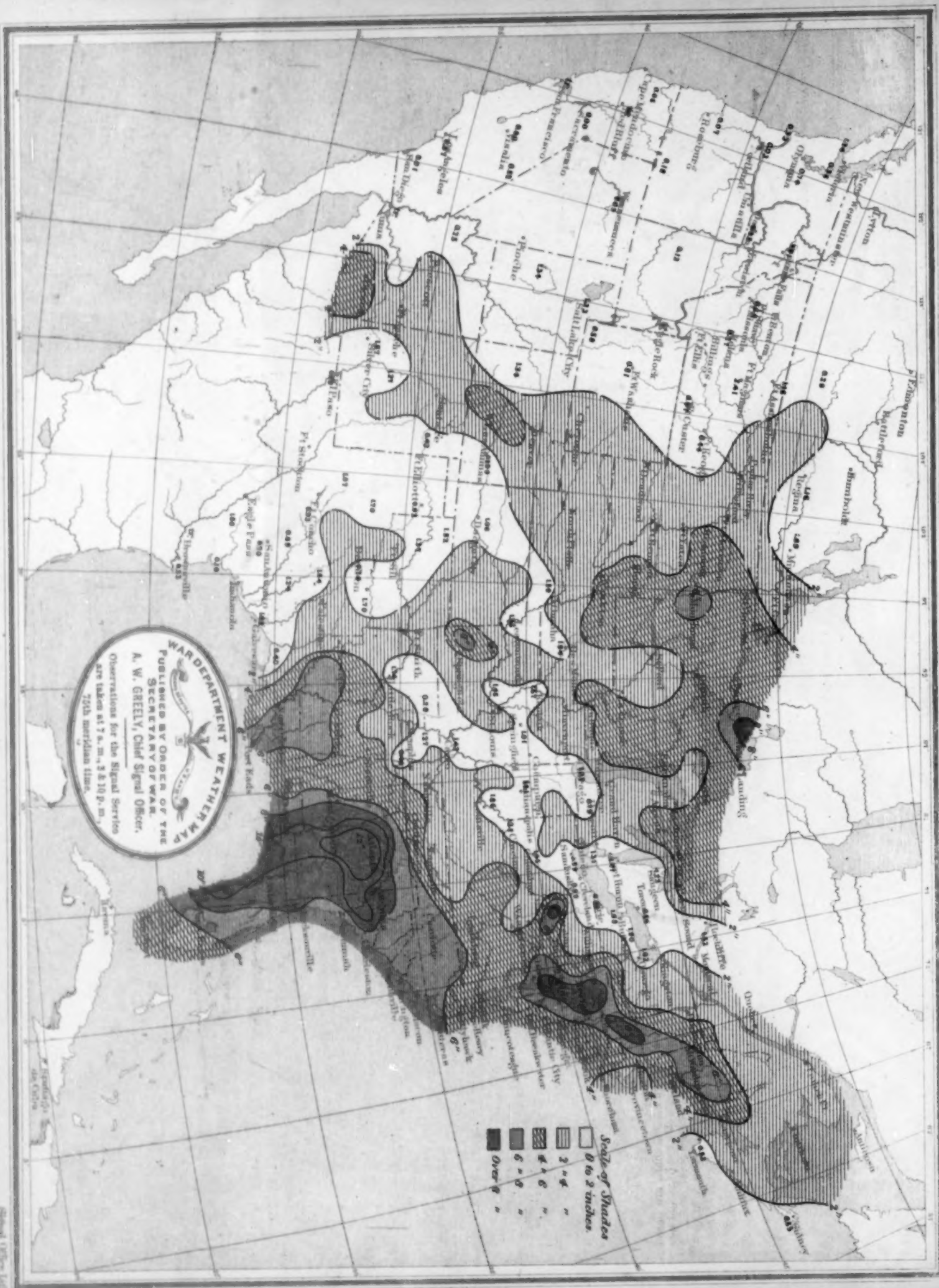
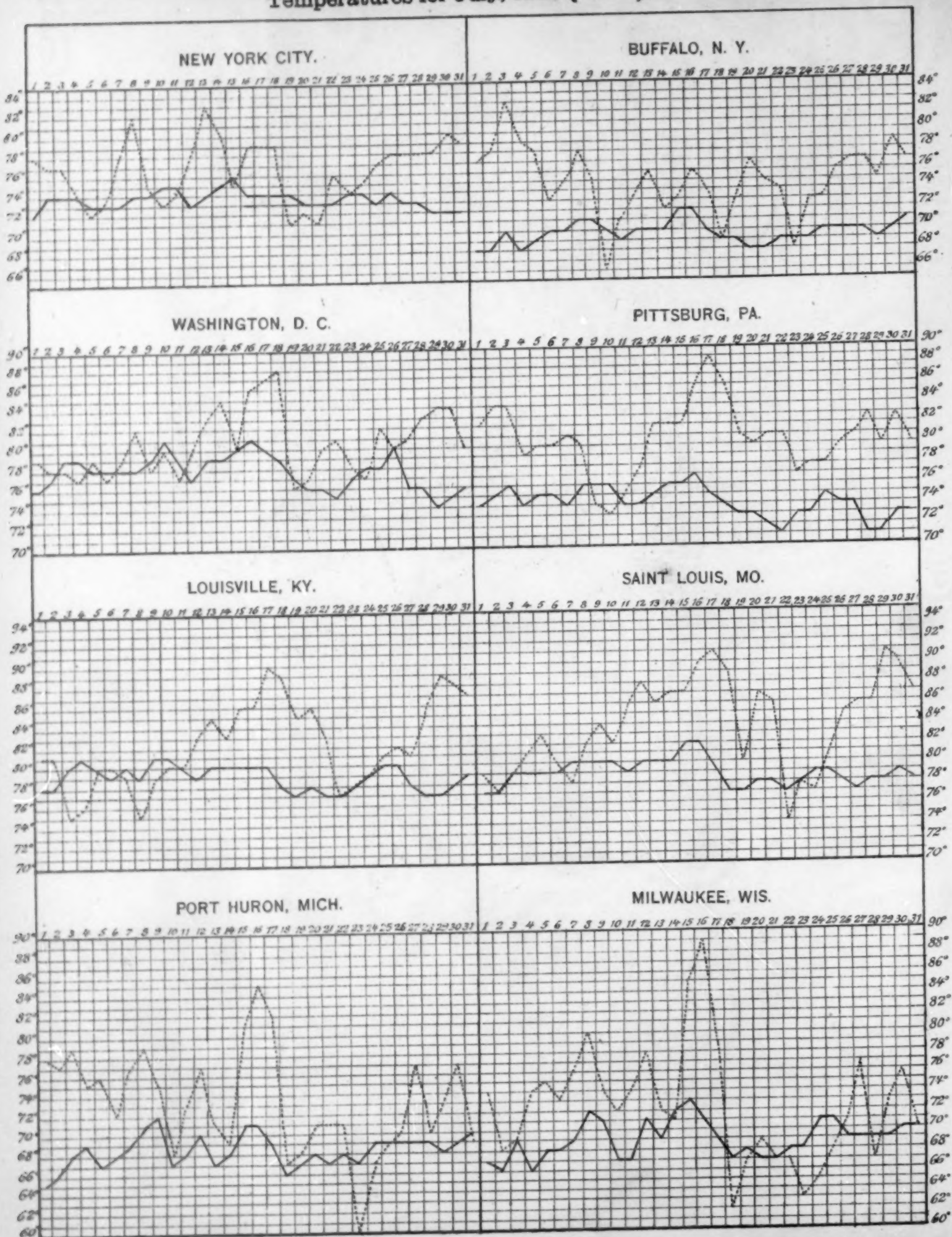


Chart III. Precipitation, July 1887.



WAR DEPARTMENT WEATHER MAP
 PUBLISHED BY ORDER OF THE
 SECRETARY OF WAR.
 A. W. GREELY, Chief Signal Officer.
 Observations for the Signal Service
 are taken at 7 a. m., 3 & 10 p. m.
 75th meridian time.

Chart V. Normal July Temperatures for a number of years (——). Mean Temperatures for July, 1887 (.....).



Observer and place of observation.	Observer and place of observation.	Observer and place of observation.	Observer and place of observation.
Alexander, S., Birmingham, Mich.	Deming, H. D., Wellsborough, Pa.	Loveland, Wm. Corry, Pa.	Sonedecker, Rev. T. H., Tiffin, Ohio.
Anderson, Dr. W. W., Stateburg, S. C.	Downing, A. L., Concord, N. H.	Loomis, J. C., Jeffersonville, Ind.	Smith, John R., North Truro, Mass.
Altamir, J. M., Independence, Kans.	Dunn, Samuel A., Brooklyn, N. Y.	Logan, David, Meadville, Pa.	Sim, J. R., Summit, Va.
Abbott, Dr. E. K., Salinas, Cal.	Dozier, Wm., Mattoon, Ill.	Luther, S. M., Garrettsville, Ohio.	Scribner, H. F. J., Stratford, Vt.
Arents, Hiram, Oroville, Cal.	Dewhurst, Rev. E., Voluntown, Conn.	Lerch & Rice, Bethlehem, Pa.	Strong, S. B., Setauket, N. Y.
Adams, A. H., Fort Meade, Fla.	Day, Theodore, Dyberry, Pa.	Lee, Elon, Webster City, Iowa.	Swartz, John J., Parkston, Dak.
Andrews, Luman, Southington, Conn.	Edgington, R. P., Morse Kans.	Louder, R. T., Clarksburg, W. Va.	Samostz, Oscar, Austin, Tex.
Avey, O. H., Oskaloosa, Iowa.	Elison, W. A., Statesville, N. C.	McDonogh Institute, McDonogh, Md.	Smith, George F., New Midway, Md.
Beans, Thos. J., Moorestown, N. J.	Ellis, John, Marquette, Nebr.	McClintock, Frank, Grand Junction, Colo.	Standenmayer, Dr. L. R., Lincoln, N. C.
Bell, Joseph, Franklin, Pa.	Ewell, Dr. M. D., South Evanston, Ill.	Morgan, L. Ray, Philipsburg, Pa.	Trembley, Dr. J. B., Oakland, Cal.
Boerner, Prof. Chas. G., Vevay, Ind.	Evans, J. W., Alma, Colo.	Marshall, Gregory, Cresco, Iowa.	Thornton, Prof. N. W., Geneseo, Ill.
Bentley, David, Willows, Cal.	Ellsworth, W. W., Hartford, Conn.	Massachusetts Agricultural Experimental Station, Amherst, Mass.	Tilford, C. M., Mount Blanco, Tex.
Bayerly, J. F., Spartanburg, S. C.	Eckstein, Rev. M., Conception, Mo.	McCready, Miss L. A., Ft. Madison, Iowa.	Tillinghast, C. B., Albany, N. Y.
Bailou, Dr. N. E., Sandwich, Ill.	Ferris, B. F., Sunman, Ind.	Miller, H. D., Drifton, Pa.	Teele, Rev. A. K., Blue Hill, Mass.
Bennett, Geo., Bandon, Oregon.	Friend, Chas. W., Carson City, Nev.	McGahan, Dr. C. F., Hot Springs, N. C.	Truman, Geo. S., Genoa, Nebr.
Boies, Lt. A. H., Hudson, Mich.	Ferrill, B. P., Duke, Fla.	Moore, C. R., Bird's Nest, Va.	Turnbo, Silas C., Pro Tem, Mo.
Boynton, J. F., Syracuse, N. Y.	Frear, Wm., State College, Pa.	Mikesell, Thos., Wauseon, Ohio.	Tuohy, John, Visalia, Cal.
Baker, Dr. Henry B., Lansing, Mich.	Fernald, Prof. M. C., Orono, Me.	Micklem, J. H., Variety Mills, Va.	Terborg, Rev. J. E., Pekin, Ill.
Beall, Dr. E. L., Lenoir, N. C.	Fleming, John, Readington, N. J.	Macrae, Collin, Kirkwood, S. C.	Thompson, R. J., Tiffin, Ohio.
Brendel, Dr. Fred., Peoria, Ill.	Fuller, Edw. N., Tacoma, Wash.	Meehan, Thomas, Germantown, Pa.	Voegeli, Adolphus, Des Moines, Iowa.
Bartlett, E. B., Vermillion, N. Y.	Featherston, Wm., Globe, Kans.	McDowell, W. R., Highmore, Dak.	Went, E. C., Frankfort, Ky.
Briggs, John, Albany, Oregon.	Field, T. G., Parkersburg, W. Va.	Moore, Dr. J. W., Easton, Pa.	Wade, J. S., Homelands, Fla.
Betts, Prof. Arthur, Webster, Dak.	Ford, H. C., El Dorado, Kans.	Motte, Luke S., West Milton, Ohio.	Washburn Observatory, Madison, Wis.
Breed, J. E., Embarras, Wis.	Gibson, J. H., Salina, Kans.	Moore, Nathan, Grampian Hills, Pa.	Wild, Rev. E. P., Newport, Vt.
Beloit College, Observatory, Beloit, Wis.	Gates, W. B., Burlington, Vt.	Mitchell, Dr. D. W., Harrisville, Mich.	Williams, Geo. S., Ashwood, Tenn.
Birt, Thomas, Utica, N. Y.	Gray, F. R., Yates Centre, Kans.	Newcomb, G. S., Westborough, Mass.	Wadsworth, Dr. J. L., Collinsville, Ill.
Broberg, Mrs. Mary W., Manatee, Fla.	Gillingham, Milnor, Fallsington, Pa.	Newell, W. C. T., Henry, Dak.	West, Silas, Cornish, Me.
Black, W. H., Kalamazoo, Mich.	Goodspeed, Chas. W., Elyria, Ohio.	Norcom, Prof. T. J., Reidsville, N. C.	Wells, Rev. Charles L., Gardiner, Me.
Blachly, C. P., Manhattan, Kans.	Gowey, H. D., North Lewisburg, Ohio.	Neal, Dr. J. C., Archer, Fla.	Wylie, Wm., Mount Forest, Canada.
Blake, W. H., Saluda, N. C.	Green, Dr. Jesse C., West Chester, Pa.	Osborn, Dr. T. C., Cleburne, Tex.	Walt, S. E., Traverse City, Mich.
Bridges, Q. A., Berlin Mills, N. H.	Gerrish, S. H., Sacramento, Cal.	Olds, H. D., Cedar Rapids, Iowa.	Washington Receiving Reservoir, D. C.
Bowman, Peter, Ruggles, Ohio.	Goodwin, Rev. William, North Colebrook, Conn.	Ogden, Charles, Elkin, Ky.	Aqueduct, Great Falls Reservoir, Md.
Boyd, Joseph, Oskaloosa, Iowa.	Gordon, Dr. G. G., Swartz Creek, Mich.	Owsley, Dr. J. B., Jacksonborough, O.	Rock Creek Bridge, D. C.
Cook, S. A., Milledgeville, Ga.	Gibbs, Geo. L., Grand Turk, Turk's Island, British W. Indies.	Pearce, Thomas, Eola, Oregon.	Woodstock College, Woodstock, Md.
Carrington, G. D., Brownville, Nebr.	Garlick, Rev. Dr. J. R., Brington, Va.	Prouty, Florence, Humboldt, Iowa.	Williams College Observatory, Williamstown, Mass.
Calhoun, P. B., Austin, Tenn.	Gray, Capt. A. W., Kenewick, Wash.	Partridge, J. M., North Volney, N. Y.	Wolfe, John H., Wellington, Kans.
Carpenter, Dr. W. B., Leavenworth, K.	Grathwohl, John, Blooming Grove, Pa.	Palmer, Frank W., Antrim, N. H.	Wulfke, E. F., Independence, Iowa.
Charbonnier, Prof. L. H., Athens, Ga.	Hamilton, W. H., Corsicana, Tex.	Pettersen, Dr. F., Comfort, Tex.	Wearmouth, James, University of Virginia, Va.
Casey, Geo., Auburn, N. Y.	Harvard College Observatory, Cambridge, Mass.	Pollock, Edw., Lancaster, Wis.	
Crawford, E. A., Liberty Hill, La.	Hammitt, John W., College Hill, Ohio.	Postma, H. Y., Egg Harbor City, N. J.	Winipiseogee Lake Cotton and Woolen Manufacturing Co., Weir's Bridge, N. H.
Cornell University, Ithaca, N. Y.	Harris, T. C., Raleigh, N. C.	Pendleton, A., Nicolaus, Cal.	Woodstock, N. H.
Carpenter, L. R., Vashon, Wash.	Heaton, Isaac E., Fremont, Nebr.	Romig, J. K., La Grande, Oregon.	Wolfeborough, N. H.
Cutting, Dr. Hiram A., Lunenburg, Vt.	Hodge, Rev. F. B., Wilkesbarre, Pa.	Richmond, S. L., Salem, N. J.	Lake Village, N. H.
Clark, F. A., Weldon, N. C.	Hoskinson, B. M., Blakely, Wash.	Renfrew, H. N., Bancroft, Iowa.	Bristol, N. H.
Casa, John J., Allison, Kans.	Holt, A. K., Riverside, Cal.	Rathburn, J. C., Midland, Tex.	Belmont, N. H.
Cowgill, Prof. E. B., Manhattan, Kans.	Hyde, G. A., Cleveland, Ohio.	Remington, C. V. S., Fall River, Mass.	Ashland, N. H.
Cutler, B. B., Heath, Mass.	Haywood, John, Westerville, Ohio.	Robertson, T. D., Rockford, Ill.	Willis, O. R., A. M., Ph. D., White Plains, N. Y.
Collie, G. L., Delavan, Wis.	Hartzler, J. A., Mottville, Mich.	Roberts, Luke, Clinton, Iowa.	Wood, Joseph, Bar Harbor, Me.
Conant Observatory, Dudley, Mass.	Hole, C. F., Butlerville, Ind.	Runge, C., New Ulf, Tex.	Wigg, Dr. Geo., East Portland, Oregon.
Cotton, Dr. D. B., Portsmouth, Ohio.	Held, Rev. F. B., Mount Angel, Oreg.	Richardson, C. F., Beverly, N. J.	Wright, J. W. A., Greensborough, Ala.
Cheney, Wm., Minneapolis, Minn.	Heatwole, L. J., Dale Enterprise, Va.	Rotch, A. L., Blue Hill Observatory, Blue Hill, Mass.	Whitney, Chas. E., Humphrey, N. Y.
College of Sacred Heart, Prairie du Chien, Wis.	Hatch, A. H., Windsor, Ill.	Rodman, Thomas R., New Bedford, Mass.	Wing, Miss M. E., Charlotte, Vt.
Carter, Rev. Dr. W. H., Tallahassee, Fla.	Harris, W. C., Dover, N. J.	Rice, Chas. W., Yellow Springs, Ohio.	Widman, Rev. C. M., Grand Coteau, La.
Cummings, L. D., Palmyra, N. Y.	Hunter, Dr. T. C., Napoleon, Ohio.	Swezey, Prof. G. D., Crete, Nebr.	Williams, Dr. A. C., Elk Falls, Kans.
Crump, M. H., Bowling Green, Ky.	Hewit, S. F. H., Middlebrook, W. Va.	Stern, Jacob T., Logan, Iowa.	Wedge, J. C., Fond du Lac, Wis.
Crozier, Lafa, Laconia, Ind.	Helm, Thos. B., Logansport, Ind.	Smith, H. D., Monticello, Iowa.	White, Rev. J. H., Georgiana, Fla.
Cochran, Wm. P., Wakefield, Kans.	Heacock, J. L., Quakertown, Pa.	Shaw, E., Ninescah, Kans.	Wilson, W. T., Clayton, N. J.
Caulkins, John S., Thornville, Mich.	Hazen, Rev. A., Deerfield, Mass.	Seltz, Chas., De Soto, Nebr.	Wetmore, Edw. L., Tucson, Ariz.
Cole, Seward, Cahuenga, Cal.	Harper, E. G., Harper's Ferry, Ky.	Shriver, E. T., Cumberland, Md.	Whitmore, J. E., Gallinas Spring, N. Mex.
Chandler, Dr. W. J., South Orange, N. J.	James, John W., Marengo, Ill.	Simmons, Prof. W. G., Wake Forest, N. C.	Walton, J. P., Muscatine, Iowa.
Cass, W. Earle, Roseland, N. J.	Jennings, T. B., Marydale Farm, Kans.	Schleicher, Rob't Lewiston, Idaho.	Waterman, Wm., Hay Springs, Nebr.
Curtiss, G. G., Fallston, Md.	Jones, Dr. E. U., Taunton, Mass.	Shriver, Howard, Wytheville, Va.	Webster, Chas. H., Nashua, N. H.
Dow, Roswell, Sycamore, Ill.	Jordan, Dr. M. D., Milan, Tenn.	Scott, Thos. G., Forsyth, Ga.	Yates, T. P., Factoryville, N. Y.
Dinsmore, Prof. F. H., Emporia, Kans.	Kirkwood, E., Maury, Ind.	Silvius, Urius O., Franklin, Wis.	Yetter, Wm. G., Catawissa, Pa.
Dollenmayer, E. T., Wilson, Kans.	Knapp, J. G., Limona, Fla.	Stucky, Dr. C. T., Helvetia, W. Va.	Young, Geo. R., Penn Yan, N. Y.
Dechant, C. M., Reading, Pa.	Keese, G. Pomeroy, Cooperstown, N. Y.	Slade, Elisha, Somerset, Mass.	
Dudley, Chas. B., Altoona, Pa.	Lincoln, A. T., Marion, Va.		
Dunlap, W. L., Tecumseh, Nebr.			
Dazey, J. B., Charleston, Ill.			

Military posts from which meteorological reports were received, through the Surgeon General of the Army, in time to be used in the preparation of the Monthly Weather Review for July, 1887.

Alcatraz Island, Cal.	Gaston, Fort, Cal.	Missoula, Fort, Mont.	Niagara, Fort, N. Y.	Snelling, Fort, Minn.	Sidney, Fort, Nebr.
Angel Island, Cal.	Gibson, Fort, Ind. T.	Mason, Fort, Cal.	Niobrara, Fort, Nebr.	St. Francis Bk's, St. Augustine, Fla.	Totten, Fort, Dak.
A. Lincoln, Fort, Dak.	Hays, Fort, Kans.	McDermitt, Fort, Nev.	Pembina, Fort, Dak.	Sisseton, Fort, Dak.	Townsend, Ft., Wash.
Bayard, Fort, New Mex.	Hof Springs, Ark.	McDowell, Fort, Ariz.	Presidio of San F., Cal.	Shaw, Fort, Mont.	Union, Fort, N. Mex.
Benicia Barracks, Cal.	Huachuca, Fort, Ariz.	Monroe, Fort, Va.	Plattsburg Barracks, N. Y.	Sherman, Fort, Idaho.	Washakie, Fort, Wyo.
Bidwell, Fort, Cal.	Klamath, Fort, Oreg.	Mojave, Fort, Ariz.	Robinson, Fort, Nebr.	Selden, Fort, Nebr.	West Point Military Academy, N. Y.
Brady, Fort, Mich.	Keogh, Fort, Mont.	Madison Barracks, N. Y.	Reno, Fort, Ind. T.	Supply, Fort, Ind. T.	Walla Walla, Ft., Wash.
Boise Barracks, Idaho.	Lewis, Fort, Colo.	McHenry, Fort, Md.	Randall, Fort, Dak.	Sully, Fort, Dak.	Wingate, Fort, N. Mex.
Concho, Fort, Tex.	Laramie, Fort, Wyo.	Mount Vernon Bks, Ala.	Ringgold, Fort, Tex.	Spokane Fort, Wash.	Yates, Fort, Dak.
Columbus, Fort, N. Y.	McIntosh, Fort, Tex.	McKinney, Fort, Wyo.	Riley, Fort, Kans.		
Camp Sheridan, Wyo.					

State weather services from which meteorological reports were received in time to be used in the preparation of the Monthly Weather Review for July, 1887.

Arkansas, W. U. Simons, Private, Signal Corps, Little Rock, Ark.	New England Meteorological Society, Prof. Wm. H. Niles, of Boston, Mass., President; Prof. W. M. Davis, of Cambridge, Mass., Secretary.
Illinois, Col. Charles F. Mills, director, Springfield, Ill.	New Jersey, Prof. George H. Cook, director, New Brunswick, N. J.
Indiana, Prof. H. A. Huston, director, Lafayette, Ind.	North Carolina, Dr. Charles W. Dabney, Jr., director, Raleigh, N. C.
Iowa, Dr. Gustavus Hinrichs, Iowa City, Iowa.	Ohio, Prof. Benj. F. Thomas, director, Ohio State University, Columbus, Ohio.
Kansas, Prof. J. T. Lovewell, director, Topeka, Kans.	Oregon, B. S. Pague, Private, Signal Corps, Roseburg, Oregon.
Michigan, N. B. Conger, Sgt., Signal Corps, director, Lansing, Mich.	South Carolina, Hon. A. P. Butler, director, Columbia, S. C.
Minnesota, Prof. W. W. Payne, director, Northfield, Minn.	Tennessee, J. D. Plunket, M. D., director; H. C. Bate, assistant, Nashville, Tenn.
Mississippi, Prof. R. B. Fulton, director, Oxford, Miss.	
Missouri, Prof. Francis E. Nipher, director, Saint Louis, Mo.	
Nebraska, Prof. Goodwin D. Swezey, Director, Crete, Nebr.	